



AGRICULTURAL RESEARCH INSTITUTE

PUSA



THE RHODESIA
Agricultural Journal.

Issued by the Department of Agriculture.

VOLUME XIX.

1922.

314274
■■■■■■■■■■
IARI

PUBLISHED BI-MONTHLY.

PRINTED BY THE ARGUS P. & P. CO., LTD., SALISBURY, RHODESIA

Contents.

EDITORIAL :

	PAGE
The New Year	1
The Poultry Industry	2
The Dairy Industry	3
Crop Statistics	4
Crop Experiments	4
Milk Records	5
Fruit Growers' Exchange of South Africa, Ltd	5
A History of Stock Diseases in Southern Rhodesia	7
Maize Yields	7
The Salisbury Show	8
Ground Nuts	8
Exportation of Plants Seeds, etc	9

ARTICLES

A Short History of the Infective Diseases amongst the Domestic Animals of Southern Rhodesia since the Occupation by J. M. Sinclair, M R C V S	10
The Velvet Bean, by J. A. T. Walters, B A	21
Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1920-21, by H. C. K. Fynn	29
Common Mistakes in Growing and Handling Virginia Tobacco by H. W. Taylor, B Agr	37
Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F L S	45
The Cattle Industry, by Eric A. Nobbs, Ph D B Sc	53
Water Power Resources of Southern Rhodesia, by C. L. Robertson B.Sc., A M I C E	56
Crop Experiments, 1921-22—Salisbury and Gwebi	64
Arlington Sand Veld Experiment Station, by H. G. Mundy, F L S and E. E. Wright	68
Limestones in Southern Rhodesia, by G. N. Blackshaw O B E B Sc, F.I.C.	73
Poultry Husbandry—Mating, by A. Little	80
Malting Barley, by J. A. T. Walters, B A	83
A New Zealand Fruit Farm, by Miss E. C. Steedman	85
Notes on the Maize Stalk Borer or "Top Worm" by Rupert W. Jack, F.E.S.	87
Rhodesian Milk Records	90
Agricultural Outlook	92
The Second Southern Rhodesia Egg Laying Test	93
Veterinary Report for October and November 1921	96
Farming Calendar	98
Weather Bureau	105
Dates of Meetings of Farmers' Associations	111
Departmental Notices	112
Departmental Bulletins	113
Government Notices	119

BULLS


PEDIGREE & PURE BRED

ALSO HEIFERS

SHORTHORNS
FRIESLANDS
HEREFORDS
DEVONS, &c.

FROM FAMOUS
CAPE STUDS

To suit all requirements from the famous Cattle-Raising Districts of the Eastern Cape Province, the centre for which is *QUEENSTOWN, C.P.*

Expert opinion shows that the standard of the Cape Eastern Province Herds is equal to any in the World. 



RHODESIAN BUYERS

Why undertake the expense and risk of importing pedigree stock from overseas when you can do equally as well out of the fine herds of the Eastern Cape?

Amongst the famous Breeders of this District are:—

- H. T. SILLS, Carlton, Dordrecht—*Shorthorns*.
T. A. SINCLAIR, Highlands, Fort Beaufort—*Shorthorns*.
LIVINSTONE MOFFAT, Spring Valley, Tarkastad—*Shorthorns*.
F. E. FROST, King's Glen, Cyphergat—*Devons*.
W. J. HARVEY, Cottesbrook, Kroome—*Shorthorns*.
E. G. LLOYD, Queenstown—*Frieslands*.
A. V. MORUM, Box 158, Queenstown—*Shorthorns and Frieslands*.
EDWARDS BROS., Hillstone, Schoombie—*Shorthorns, Lincoln Reds*.
J. H. KING & SONS, Highland Home, Tarkastad—*Devons*.
R. P. KINGWILL, Gordonville, Graaff-Reinet—*Shorthorns*.
W. FROST, Thibet Park, Waverley—*Frieslands*.
E. S. PUGH, P.O. Waverley—*Herefords*.
W. H. BARTLETT, Blaauwkrantz, Queenstown—*Frieslands*.
PAINTER BROS., Waterfall, Kroome—*Shorthorns*.
J. J. OOSTHUIZEN, Stockton, Cathcart—*Africanders*.
G. KING & SONS, Prinston, Bedford—*Shorthorns*.
ELTON MILLS, Mimosa, Queenstown—*Frieslands*.
H. CLOETE & SONS, Herbertshope, Bedford—*Frieslands*.
ROSS & SONS, Cavers, Bedford—*Frieslands*.
K. M. MCGREGOR, Gonzana, Fort Beaufort—*Shorthorns*.
A. C. VICE & SONS, Colworth, Molteno—*Shorthorns*.
J. R. GREGORY, Charnwood, Molteno—*Shorthorns*.
C. I. HUGHES, Hughenden, Knapdaar—*Shorthorns*.
G. S. C. CAMPBELL, Rocklands, Fort Beaufort—*Shorthorns*.
E. CATHERINE, Clark's Siding, Dordrecht—*Frieslands*.
J. BEALE PRESTON, Exwell Park, Waku—*Frieslands*.

And many others equally famous.

Orders can be placed for cheaper Ranching Bulls of the various breeds named.
Enquiries and Inspection invited. Further particulars from

The Secretary,
QUEENSTOWN & EASTERN DISTRICTS AGRICULTURAL SOCIETY,
P.O. Box 173, Queenstown, C.P.

Contents.

EDITORIAL

	PAGE
A Pisé de Terre House	123
The Show Season	124
Grasses of Agricultural Importance in Southern Rhodesia	124
The Maize Trade	125
The Poultry Industry	126
Rhodesia as a Ranching Country	127
Agricultural Experiments	127
Milk Records	128
The Fruit Growing Industry	128
The Tobacco Slug	130
The Ground Nut	130
The Locust Pest	132
The Dairying Industry	132
Importation of Citrus Trees	133
Northern Rhodesia Importation Regulations	133

ARTICLES

Grasses of Agricultural Importance in Southern Rhodesia, by H G Mundy, F L S, G N Blackshaw, O B E, B Sc, F I C, and E V Flack	134
The Ground Nut or Monkey Nut, by C Mainwaring	150
Citrus Fruit Growing in Rhodesia, by A G Turner	159
A Short History of the Infective Diseases amongst the Domestic Animals of Southern Rhodesia since the Occupation, by J M Sinclair, M R C V S	169
Manufacture of Cheddar Cheese, by T Hamilton, M A, N D D, N.D.A	177
Irrigation Canals, by A C Jennings Assoc Mem Inst C E, A M I E E	187
Napier Fodder	194
Poultry Husbandry—Housing and Feeding of Adult Fowls, by A Little	200
Treatment of Tobacco Seed against Wildfire and Angular Spot in Southern Rhodesia, by D D Brown	205
The Dual Purpose Animal in Southern Rhodesia by Stock Breeder	209
The Baboon Trap, by H C K Fynn	210
Cattle Squeezer	212
Irrigation Notes—Schemes in hand and projected	214
Southern Rhodesia Egg Laying Tests	215
Veterinary Report for December, January and February	219
Agricultural Outlook	222
Rhodesian Milk Records	224
Weather Bureau	229
Dates of Meetings of Farmers' Associations	237
Farming Calendar	238
Departmental Notices	244
Departmental Bulletin	245
Government Notices	251

BULLS


PEDIGREE &
PURE BRED

ALSO HEIFERS

SHORTHORNS
FRIESLANDS
HEREFORDS
DEVONS, &c.

FROM FAMOUS
CAPE STUDS

To suit all requirements from the famous Cattle-Raising Districts of the Eastern Cape Province, the centre for which is *QUEENSTOWN, C.P.*

Expert opinion shows that the standard of the Cape Eastern Province Herds is equal to any in the World. 



RHODESIAN BUYERS

Why undertake the expense and risk of importing pedigree stock from overseas when you can do equally as well out of the fine herds of the Eastern Cape?

Amongst the famous Breeders of this District are:—

- H. T. SILLS, Carlton, Dordrecht—Shorthorns.
T. A. SINCLAIR, Highlands, Fort Beaufort—Shorthorns.
LIVISTONE MOFFAT, Spring Valley, Tarkastad—Shorthorns.
F. E. FROST, King's Glen, Cyphergat—Devons.
W. J. HARVEY, Cottesbrook, Kroonie—Shorthorns.
E. G. LLOYD, Queenstown—Frieslands.
A. V. MORUM, Box 158, Queenstown—Shorthorns and Frieslands.
EDWARDS BROS., Hillstone, Schoombie—Shorthorns, Lincoln Reds.
J. H. KING & SONS, Highland Home, Tarkastad—Devons.
R. P. KINGWILL, Gordonville, Graaff-Reinet—Shorthorns.
W. FROST, Thibet Park, Waverley—Frieslands.
E. S. PUGH, P.O. Waverley—Herefords.
W. H. BARTLETT, Blaauwkrantz, Queenstown—Frieslands.
PAINTER BROS., Waterfall, Kroonie—Shorthorns.
J. J. OOSTHUIZEN, Stockton, Cathcart—Africanders.
G. KING & SONS, Primeston, Bedford—Shorthorns.
ELTON MILLS, Mimosa, Queenstown—Frieslands.
H. CLOETE & SONS, Herbertshope, Bedford—Frieslands.
ROSS & SONS, Cavers, Bedford—Frieslands.
K. M. MCGREGOR, Gonzana, Fort Beaufort—Shorthorns.
A. C. VICE & SONS, Colworth, Molteno—Shorthorns.
J. R. GREGORY, Charnwood, Molteno—Shorthorns.
C. I. HUGHES, Hughenden, Knapdaar—Shorthorns.
G. S. C. CAMPBELL, Rocklands, Fort Beaufort—Shorthorns.
E. CATHERINE, Clark's Siding, Dordrecht—Frieslands.
J. BEALE PRESTON, Exwell Park, Waku—Frieslands.

And many others equally famous.

Orders can be placed for cheaper Ranching Bulls of the various breeds named.
Enquiries and Inspection invited. Further particulars from

The Secretary,
QUEENSTOWN & EASTERN DISTRICTS AGRICULTURAL SOCIETY,
P.O. Box 173, Queenstown, C.P.

Contents.

	PAGE
EDITORIAL :	
Rhodesia Agricultural Union	255
Visit to Gwebi Experiment Farm	256
A Rhodesia Egg Circle	257
The Drought	258
Locusts in Rhodesia	259
Rhodesian Leather	260
African Coast Fever	261
Customs Returns	261
The Budget	262
A Settlers' Guide	263
Milk Records	263
Salisbury Show	264
Maize Growers	265
The White Poplar	265
ARTICLES :	
From Breeder to Butcher—Cattle Feeding Experiment No. 9, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.	267
A Short History of the Infective Diseases amongst the Domestic Animals of Southern Rhodesia since the Occupation, by J. M. Sinclair, M.R.C.V.S.	276
The Relative Areas of Geological Formations in Southern Rhodesia, by H. B. Maufe	280
The Use of Pure Bred Sires for Dairy Herds, by T. Hamilton, M.A., N.D.D., N.D.A.	282
Beggar Weed and Kudzu Vine	288
Improvement of Rhodesian White Maize by Selection, by C Mainwaring	291
The Common Sunflower, by C. Mainwaring	295
Citrus Fruit Growing in Rhodesia, by A. G. Turner	301
Report of the Director of Agriculture for the year 1921	313
Notes from the Entomological Branch, by Rupert W. Jack, F.E.S.	333
White <i>versus</i> Yellow Maize	339
Velvet Beans	341
The Flaying, Curing and Drying of Hides, by R. R. Needham	342
Correspondence	344
Veterinary Report for March	345
Agricultural Outlook	346
Farming Calendar	346
Southern Rhodesia Weather Bureau	353
Dates of Meetings of Farmers' Associations	362
Departmental Notices	363
Review	373
Departmental Bulletins	374
Government Notices	380

BULLS


SHORTHORNS FRIESLANDS HEREFORDS DEVONS, &c.

PEDIGREE & PURE BRED

ALSO HEIFERS

FROM FAMOUS CAPE STUDS

To suit all requirements from the famous Cattle-Raising Districts of the Eastern Cape Province, the centre for which is *QUEENSTOWN, C.P.*

Expert opinion shows that the standard of the Cape Eastern Province Herds is equal to any in the World. 



RHODESIAN BUYERS

Why undertake the expense and risk of importing pedigree stock from overseas when you can do equally as well out of the fine herds of the Eastern Cape?

Amongst the famous Breeders of this District are:—

- H. T. SILLS, Carlton, Dordrecht—Shorthorns.
- T. A. SINCLAIR, Highlands, Fort Beaufort—Shorthorns.
- LIVINSTONE MOFFAT, Spring Valley, Tarkastad—Shorthorns.
- F. E. FROST, King's Glen, Cyphergat—Devons.
- W. J. HARVEY, Cottesbrook, Kroonie—Shorthorns.
- E. G. LLOYD, Queenstown—Frieslands.
- A. V. MORUM, Box 158, Queenstown—Shorthorns and Frieslands.
- EDWARDS BROS., Hillstone, Schoombie—Shorthorns, Lincoln Reds.
- J. H. KING & SONS, Highland Home, Tarkastad—Devons.
- R. P. KINGWILL, Gordonville, Graaff-Reinet—Shorthorns.
- W. FROST, Thibet Park, Waverley—Frieslands.
- E. S. PUGH, P.O. Waverley—Herefords.
- W. H. BARTLETT, Blaauwkrantz, Queenstown—Frieslands.
- PAINTER BROS., Waterfall, Kroonie—Shorthorns.
- J. J. OOSTHUIZEN, Stockton, Cathcart—Africanders.
- G. KING & SONS, Primeston, Bedford—Shorthorns.
- ELTON MILLS, Mimosa, Queenstown—Frieslands.
- H. CLOETE & SONS, Herbertshope, Bedford—Frieslands.
- ROSS & SONS, Cavers, Bedford—Frieslands.
- K. M. MCGREGOR, Gonzana, Fort Beaufort—Shorthorns.
- A. C. VICE & SONS, Colworth, Molteno—Shorthorns.
- J. R. GREGORY, Charnwood, Molteno—Shorthorns.
- C. I. HUGHES, Hughenden, Knapdaar—Shorthorns.
- G. S. C. CAMPBELL, Rocklands, Fort Beaufort—Shorthorns.
- E. CATHERINE, Clark's Siding, Dordrecht—Frieslands.
- J. BEALE PRESTON, Exwell Park, Waku—Frieslands.

And many others equally famous.

Orders can be placed for cheaper Ranching Bulls of the various breeds named.
Enquiries and Inspection invited. Further particulars from

The Secretary,
QUEENSTOWN & EASTERN DISTRICTS AGRICULTURAL SOCIETY,
P.O. Box 173, Queenstown, C.P.

Contents.

EDITORIAL :

	PAGE
Statistics	383
East Coast Fever	384
The Citrus Industry	384
Malaria and Blackwater Fever	384
A Baboon Trap	385
Velvet Beans	385
Our Exports	386
An Export Trade in Ground Nuts	387
Rhodesian Milk Records	388
Trout in Rhodesia	389
The Tobacco Industry	389
Irrigation Loans	390
Sunn Hemp Seed from Rhodesia	390
Pig Breeding in Rhodesia	392

ARTICLES :

Statistics of Live Stock and Animal Products for the Year 1921, by H. C. K. Fynn	393
Common Defects in Butter Making, by T. Hamilton, M.A., N.D.A., N.D.D.	402
The Sweet Potato, by J. A. T. Walters, B.A. . . .	411
Rhodes Inyanga Estate—Cattle Returns, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.	419
Report of the Chief Veterinary Surgeon for the Year 1921 ...	429
Propagation of Kudzu Vine, by H. C. Arnold	435
Pasture Plants and Grasses in Rhodesia	439
The Shows	444
The Cattle Industry, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.	453
The Toon Tree	458
Climatic Areas in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.	459
Irrigation Notes	462
Second Southern Rhodesia Egg-Laying Test	463
Veterinary Report for April and May	465
Agricultural Outlook	468
Review	470
Rhodesian Milk Records	471
Farming Calendar	473
Weather Bureau	479
Dates of Meetings of Farmers' Associations	486
Departmental Notices	487
Departmental Bulletins	491
Government Notices	497

BULLS


PEDIGREE &
PURE BRED

ALSO HEIFERS

SHORTHORNS
FRIESLANDS
HEREFORDS
DEVONS, &c.

FROM FAMOUS
CAPE STUDS

To suit all requirements from the famous Cattle-Raising Districts of the Eastern Cape Province, the centre for which is *QUEENSTOWN, C.P.*

Expert opinion shows that the standard of the Cape Eastern Province Herds is equal to any in the World. 



RHODESIAN BUYERS

Why undertake the expense and risk of importing pedigree stock from overseas when you can do equally as well out of the fine herds of the Eastern Cape?

Amongst the famous Breeders of this District are:—

- H. T. SILLS, Carlton, Dordrecht—Shorthorns.
- T. A. SINCLAIR, Highlands, Fort Beaufort—Shorthorns.
- LIVINSTONE MOFFAT, Spring Valley, Tarkastad—Shorthorns.
- F. E. FROST, King's Glen, Cyphengat—Devons.
- W. J. HARVEY, Cotteshook, Kroomie—Shorthorns.
- E. G. LLOYD, Queenstown—Frieslands.
- A. V. MORUM, Box 158, Queenstown—Shorthorns and Frieslands.
- EDWARDS BROS., Hillstone, Schoombie—Shorthorns, Lincoln Reds.
- J. H. KING & SONS, Highland Home, Tarkastad—Devons.
- R. P. KINGWILL, Gordonville, Graaff-Reinet—Shorthorns.
- W. FROST, Thibet Park, Waverley—Frieslands.
- E. S. PUGH, P.O. Waverley—Herefords.
- W. H. BARTLETT, Blaauwkrantz, Queenstown—Frieslands.
- PAINTER BROS., Waterfall, Kroomie—Shorthorns.
- J. J. OOSTHUIZEN, Stockton, Cathcart—Africanders.
- G. KING & SONS, Primmston, Bedford—Shorthorns.
- ELTON MILLS, Mimosa, Queenstown—Frieslands.
- H. CLOETE & SONS, Herbertshope, Bedford—Frieslands.
- ROSS & SONS, Cavers, Bedford—Frieslands.
- K. M. MCGREGOR, Gonzana, Fort Beaufort—Shorthorns.
- A. C. VICE & SONS, Colworth, Molteno—Shorthorns.
- J. R. GREGORY, Charnwood, Molteno—Shorthorns.
- C. I. HUGHES, Hughenden, Knapdaar—Shorthorns.
- G. S. C. CAMPBELL, Rocklands, Fort Beaufort—Shorthorns.
- E. CATHERINI, Clark's Siding, Dordrecht—Frieslands.
- J. BEALE PRESTON, Exwell Park, Waku—Frieslands.

And many others equally famous.

Orders can be placed for cheaper Ranching Bulls of the various breeds named.
Enquiries and Inspection invited. Further particulars from

The Secretary,

QUEENSTOWN & EASTERN DISTRICTS AGRICULTURAL SOCIETY,
P.O. Box 173, Queenstown, C.P.

Contents.

EDITORIAL.	PAGE.
A Pisé de Terre House	503
Maize Matters	504
Seed Maize	504
Yellow & White Maize	505
Costs of Maize Production	506
High and Low Yeld Maize	506
The Salisbury Show	507
Children's Cattle Judging Competition	509
The Pig Industry	510
Cotton	511
Milk Records	512
The Rhodesia Egg Circle	512
Tobacco Yields	513
Rhodesian Maize Successes at Johannesburg	514
ARTICLES	
Farming Returns for Income Tax Purposes	515
Chillies in Rhodesia by G. H. Gordon	535
Annual Report of Experiments, 1921-22 Experiment Station, Salisbury, by H. G. Mundy, F.L.S.	536
Seed Supply in Rhodesia, by C. Mamwaring	546
The Cattle Industry, by Eric A. Nobbs, Ph.D., B.Sc. F.H.A.S.	551
The History, Control and Treatment of Infectious Abortion of Cattle in Southern Rhodesia, by L. E. W. Bevan, M.R.C.V.S.	554
Insect Pests of Fruits other than Citrus in Southern Rhodesia by Rupert W. Jack, F.E.S.	569
Bulawayo Municipal Experiment Station- First Report by H. G. Mundy, F.L.S.	585
From Breeder to Butcher Cattle Feeding Experiment No. 10 by H. G. Mundy F.L.S.	588
Winter Cereal Experiments Season 1921, by D. E. McLoughlin	595
Some Common Diseases of Poultry, by A. Little	601
Report of the Veterinary Bacteriologist for the Year 1921	605
Review	612
Rates for Pigs Consigned to the Union	614
Salisbury Show Milking Competition	616
Rhodesian Milk Records	618
Veterinary Report for June and July	619
Agricultural Outlook	621
Farming Calendar	623
Dates of Meetings of Farmers' Associations	629
Departmental Notices	630
Departmental Bulletins	632
Government Notices	633

BULLS


PEDIGREE &
PURE BRED

ALSO HEIFERS

SHORTHORNS
FRIESLANDS
HEREFORDS
DEVONS, &c.

FROM FAMOUS
CAPE STUDS

To suit all requirements from the famous Cattle-Raising Districts of the Eastern Cape Province, the centre for which is *QUEENSTOWN, C.P.*

Expert opinion shows that the standard of the Cape Eastern Province Herds is equal to any in the World. 



RHODESIAN BUYERS

Why undertake the expense and risk of importing pedigree stock from overseas when you can do equally as well out of the fine herds of the Eastern Cape?

Amongst the famous Breeders of this District are:—

- H. T. SILLS, Carlton, Dordrecht—Shorthorns.
- T. A. SINCLAIR, Highlands, Fort Beaufort—Shorthorns.
- LIVINSTONE MOFFAT, Spring Valley, Tarkastad—Shorthorns.
- F. E. FROST, King's Glen, Cyphergat—Devons.
- W. J. HARVEY, Cottesbrook, Kroonme—Shorthorns.
- E. G. LLOYD, Queenstown—Frieslands.
- A. V. MORUM, Box 158, Queenstown—Shorthorns and Frieslands.
- EDWARDS BROS., Hillstone, Schoombie—Shorthorns, Lincoln Reds.
- J. H. KING & SONS, Highland Home, Tarkastad—Devons.
- R. P. KINGWILL, Gordonville, Graaff-Reinet—Shorthorns.
- W. FROST, Thibet Park, Waverley—Frieslands.
- E. S. PUGH, P.O. Waverley—Herefords.
- W. H. BARTLETT, Blaauwkrantz, Queenstown—Frieslands.
- PAINTER BROS., Waterfall, Kroonme—Shorthorns.
- J. J. OOSTHUIZEN, Stockton, Cathcart—Africanders.
- G. KING & SONS, Primeston, Bedford—Shorthorns.
- ELTON MILLS, Mimosa, Queenstown—Frieslands.
- H. CLOETE & SONS, Herbertshope, Bedford—Frieslands.
- ROSS & SONS, Cavers, Bedford—Frieslands.
- K. M. MCGREGOR, Gonzana, Fort Beaufort—Shorthorns.
- A. C. VICE & SONS, Colworth, Molteno—Shorthorns.
- J. R. GREGORY, Charnwood, Molteno—Shorthorns.
- C. I. HUGHES, Hughenden, Knapdaar—Shorthorns.
- G. S. C. CAMPBELL, Rocklands, Fort Beaufort—Shorthorns.
- E. CATHERINE, Clark's Siding, Dordrecht—Frieslands.
- J. BEALE PRESTON, Exwell Park, Waku—Frieslands.

And many others equally famous.

Orders can be placed for cheaper Ranching Bulls of the various breeds named.
Enquiries and Inspection invited. Further particulars from

The Secretary,
QUEENSTOWN & EASTERN DISTRICTS AGRICULTURAL SOCIETY,
P.O. Box 173, Queenstown, C.P.

Contents.

EDITORIAL.	PAGE
Cattle Industry Committee of Enquiry	641
African Coast Fever Enquiry	642
The Mtao Forest Reserve	642
An Additional Poultry Expert	642
Farm Food Prosecution	643
Cattle Cakes and Meals	643
The First Rhodesian Tobacco	644
Appointment of Botanist	645
Dipping Tanks	646
Farming Profits	646
Botanic Garden, Salisbury	647
Rhodesian Milk Records	647
 ARTICLES.	
The Possibility of Seasonal Forecasting and Prospects for Rainfall Season 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.	648
Annual Report of Crop Experiments, Gwebi Experiment Farm 1921-22, by H. G. Mundy, F.L.S.	650
Insect Pests of Fruits other than Citrus in Southern Rhodesia by Rupert W. Jack, F.E.S.	664
Farm Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D.	675
Odzi Canning Factory	679
Tsetse Fly, Eastern Border, by J. K. Chorley	680
Summer Irrigation in Rhodesia, by A. C. Jennings, Assoc.M.Inst.C.E.	685
Forestry in Southern Rhodesia, by J. S. Henkel	687
Annual Report of Experiments, 1921-22, Experiment Station Salisbury, by H. G. Mundy, F.L.S.	694
Some Common Diseases of Poultry, by A. Little	702
The Congo Market	705
Swamp or Irrigated Rice	709
The Cattle Industry	711
Rhodesian Produce in Europe, by J. W. Downie	715
Harvesting Operations at Gwebi Experiment Farm, by R. H. Cardwell	718
A Short History of the Infective Diseases amongst the Domestic Animals of Southern Rhodesia since the Occupation, by J. M. Sinclair, M.R.C.V.S.	720
Report of Southern Rhodesia Egg Laying Test	727
Reviews	731
Veterinary Report for August and September	734
Agricultural Outlook	738
Rhodesian Milk Records to Date	750
Price List of Forest-Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds	740
Farming Calendar	745
Weather Bureau	752
Dates of Meetings of Farmers' Associations	761
Departmental Notices	762
Departmental Bulletins	764
Government Notices	770



FERTILISERS

TO the farmer, the RIGHT
FERTILISER means a
great deal.

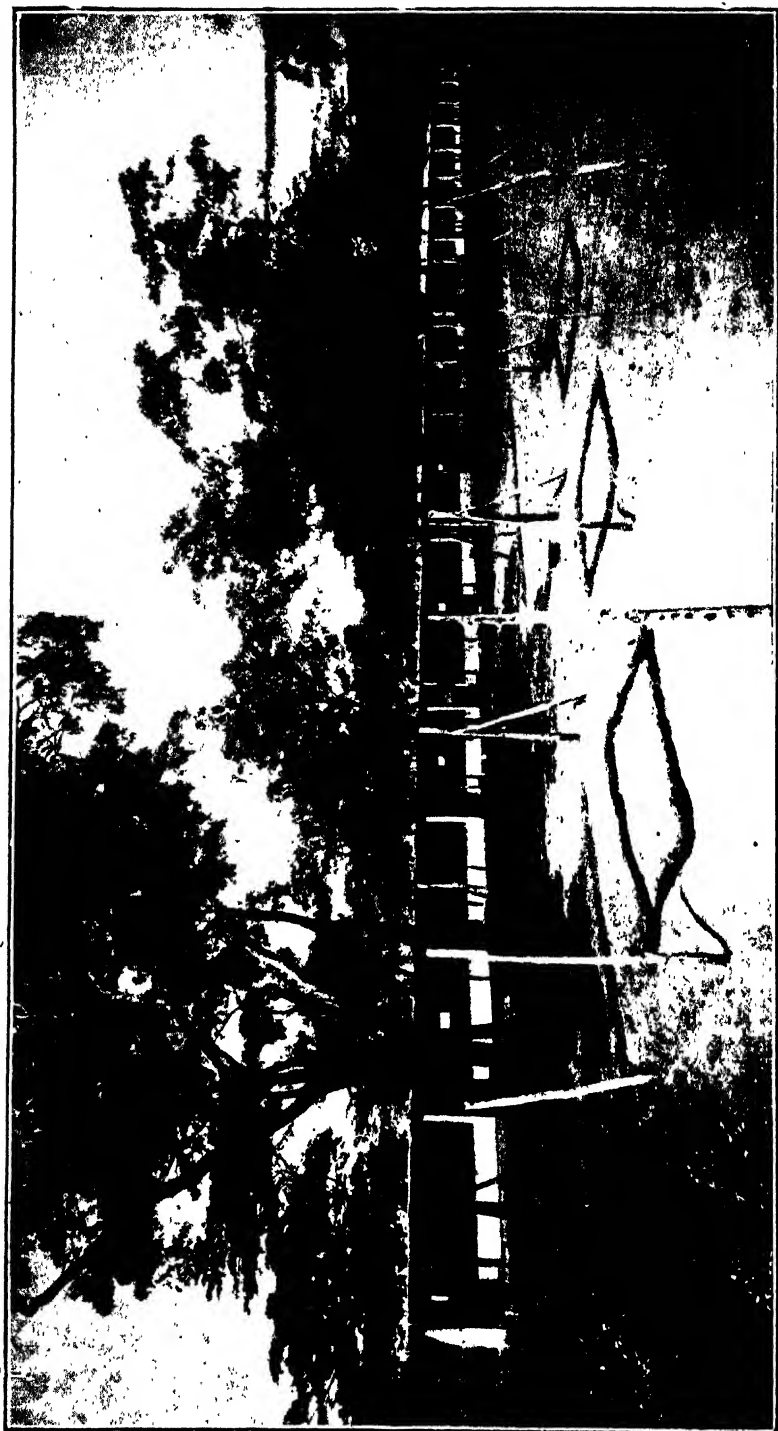
Capex Fertilisers are based on
scientific knowledge of South
African soils, and provide, in every
case, the right matter for success-
ful growth.

**CAPEX FERTILISERS ensure
good crops.**

RHODESIAN OFFICES •

P.O. BOX 683, BULAWAYO.
P.O. BOX 427, SALISBURY.

CAPE EXPLOSIVES
WORKS, LIMITED
ROBERTSON STREET, S.A.



Poultry pens, Southern Rhodesia Egg-laying Test (See Editorial note.)



THE RHODESIA
Agricultural Journal.

Issued by the Department of Agriculture.

PUBLISHED BI-MONTHLY.

Subscription: 5/- per annum.

VOL. XIX.]

FEBRUARY, 1922.

[No. 1.]

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

The New Year.—

Oor fairmer freens are sair distraught
Wi' slumps in maize and cattle;
The banks are dour and siller's scarce—
It sure wull test their mettle.

But dinna fash, it's nae sae bad,
And whaur's the use o' girnin'?
Wi' bustlin' strife they'll warsle through
And keep the hame fires burnin'.

W. C. M.

The above two stanzas, culled from a St. Andrew's Day greeting issued by the Salisbury Caledonian Society, epitomise very aptly the present agricultural outlook in Southern Rhodesia, the anxiety felt

and the determination to make good. Slumps in maize and cattle, the dourness of banks and the scarceness of siller are, however, not peculiar to Rhodesia. All over the world depression obtains, and in many parts it is more acute than here. The farmer undoubtedly is the greatest sufferer in the industrial circle, for, while the prices of his products have in many cases slumped to the pre-war figure, he still has to pay greatly enhanced prices for his requirements. The balance is against him and the ratio is being restored but slowly. However, as our poet puts it, "Wi' bustlin' strife they'll warsle through." The history of this young country of ours teems with instances of achievement in the face of incredible difficulties, and the spirit that triumphed over the trials of the past will carry us through our present time of stress. *Floreat Rhodesia.*

In starting this new volume we wish all our readers prosperity during the current year, which we trust will see a settlement of the many political and industrial disturbances which have retarded the restoration of normal conditions. We had hoped to increase our sphere of usefulness by publishing this *Journal* monthly, but financial considerations prevent this at present. We acknowledge with great appreciation the many letters received testifying to the assistance this *Journal* has been, and in doing so express the hope that our readers will continue to find its contents of the same assistance in the future. As was stated in our first number 19 years ago, it is our purpose "to form a bond between those whose common concern it is that Rhodesian agriculture should receive all possible support, encouragement and advancement."

The Poultry Industry.—The illustration which we use as a frontispiece to this issue will serve to direct attention to the egg-laying test now in progress at the experiment station and which has for its object the development of the Rhodesian poultry industry. The test is the second of the series and it will conclude on the 2nd March, having occupied a period of 48 weeks. The results have been published periodically, and these at the end of 40 weeks promise to equal those of the first test, which for the number of birds utilised constituted a South African record. A feature of the present test is the representation of heavy as well as light breeds, and it will be noticed from the report that, contrary to general expectation, the heavy breeds are holding their own. The tests are of great educative value, and it is pleasing to note that a great improvement is already noticeable throughout the country in the manner in which poultry are tended and reared. A third egg-laying competition will commence on the 1st April, and entries close on the 14th February. Full particulars have been published in the daily press, and it is hoped this test will be well supported. It is suggested that at this test owners should be allowed to run cockerels with their birds for breeding purposes, and if the consensus of opinion is in favour of this innovation it will be carried out. The public are invited to inspect the runs during the test, and information regarding the methods of feeding, etc., will be willingly given.

In the last issue of the *Journal* Mr. Little addressed an appeal to poultry keepers to co-operate with him in organising the egg production of Southern Rhodesia with a view to export. Mr. Little reports that the response has been very meagre and that the statistics he asked for have been furnished by two individuals only. This is very unsatisfactory. Poultry keepers must be aware that in the near future there will be a surplus of eggs produced in this Territory over and above local requirements, and that if poultry keeping is to return a profit this surplus must be sent out of the country. There are markets on our borders, and all that is wanted is organisation. The Government, through its Poultry Expert, is anxious to assist in every way possible, but poultry men must do their share. The matter is urgent, and we trust that the particulars called for by Mr. Little will be supplied without further delay.

The Dairy Industry.—The Rhodesian Farmers' Co-op. Industries, Ltd., have opened a small creamery in Salisbury on a favourable site near the railway station. For the time being this creamery is being used mainly as a cream depot, where cream from the districts is received, graded and tested and sent to Gwelo in bulk. As Salisbury is such a convenient centre for the cream produced in the Sinoia, Mazoe and eastern districts it is the intention to equip the building with a power plant capable of manufacturing butter on the spot, and this will shortly be installed. In the meanwhile a large hand churn has been obtained and butter is now being made.

The importance of this step in the development of the dairying industry cannot be over-estimated. Perhaps the greatest drawback with which dairy farmers in Rhodesia have had to contend has been the great distances over which cream has had to be transported to Gwelo, and in unfavourable weather it was manifestly impossible for cream to arrive at its destination in first-class condition. The establishment of creameries at Gwelo, Bulawayo and Salisbury has of course done a great deal to obviate the disability, and it should now be possible to manufacture butter in Southern Rhodesia of a quality which should compete successfully in the open market overseas. In this connection it should be pointed out that the development of the margarine industry, in Great Britain especially, has made it impossible to sell inferior butter; and now that farmers have better facilities afforded them for quick despatch of their cream to the creamery, it is essential that care should be devoted to the production of a high grade cream before it leaves the farm. This can only be obtained by cleanly methods of milking and of handling the cream. Most damage is done by neglecting to cool the cream directly after separation. The Dairy Expert has pointed out that the best way to do this is by standing the receptacle containing the cream in a tub through which cold water is constantly flowing, or to keep the cream cans surrounded by wet sacks in a cool place. If these precautions are observed we shall eventually eliminate second and third grades from our creamery price lists. The creamery has found it impossible to find a market for

third grade butter, and as competition becomes keener it is likely that nothing but first grade cream will be wanted.

As is the case with other Colonial foodstuffs, the overseas market for butter has for some months past been considerably depressed. The principal cause for this is the flooding of the markets with Government stocks which had been held in cold storages. For instance, some 150,000 tons of frozen beef and 833,000 cases of Colonial butter, approximately 25,000 tons, were suddenly released and sold for what they would fetch. There is reason to believe that prices will improve as soon as stocks are reduced.

Crop Statistics.—The annual statistics of crops which we publish in this issue show that considerable expansion of the agricultural industry occurred during the season 1920-1921. The total area under all crops, 237,268 acres, shows an increase of 26,174 acres over the figure for the previous year, while the yields of maize, tobacco and wheat all create records. The maize harvest yielded 1,220,768 bags, which is in excess of the estimate, and the average yield per acre over the whole of the Territory has risen to 6.55 bags.

The Virginia tobacco crop yielded 3,192,662 lbs. from 7,888 acres, against 2,415,607 lbs. from 5,546 acres in the previous season; while the Turkish crop amounted to 554,320 lbs. The yield per acre of Virginia tobacco is slightly less than it was in 1919-20, but the yield of Turkish tobacco shows an increase. Wheat is rapidly increasing in popularity, and the crop, so far as acreage is concerned, promises to move up into second place. During the season under review 7,118 acres were planted to wheat, against 5,139 acres in 1919-20. Practically all our wheat is grown during the dry season, either under irrigation or in moist vlei lands, of which there are large areas not yet utilised. Our bill for wheat and flour imported into the Territory during ten months of 1921 amounted to £80,234, but it is not too much to say that the whole of the wheat represented by this sum could be grown in the country.

Agricultural statistics have now been collected in Southern Rhodesia for six years, and it is pleasing to note that the great majority of farmers furnish the figures asked for promptly. There are some, however, who are very dilatory in this respect, with the result that publication of the totals is delayed. We are asked to urge these farmers to render their returns more promptly and so enable the work of compilation to be completed with the least delay possible.

Crop Experiments.—The annual reports of crop experiments conducted at the Government Experiment Station are concluded in this issue and we commend them to the earnest consideration of our readers. All the main activities of the three stations, viz., Gwebi, Salisbury and Arlington, are covered by the reports, and a bulletin reprint of each will shortly be available for free distribution.

It will be noted that the reports cover a wide field of investigation and that results of great practical value are recorded. The fact that our products now have to compete in the world's markets renders it imperative, if farming is to be profitable, that our methods be as up-to-date and scientific as possible. Many of the experiments we submit point the way to tangible improvement in crop yields, and we are pleased to state that the work of the experiment stations and the reports published have been freely discussed and favourably commented upon both by local farmers and by visitors to Rhodesia possessing a wide knowledge of experiment work in other countries. We desire that these reports should receive the fullest publicity possible, for the subject matter is of the greatest value to the farming community and deserving of careful examination by all interested in arable farming.

Milk Records.—In this issue will be found the returns for the cows entered for the milk recording scheme outlined in our October number. This scheme, we regret, has not yet gained the support which was hoped for. Dairy cows can only rightly be judged when the milk production is known, and if we are to raise the average production of Rhodesian dairy cows to a figure approaching that of other countries the farmer must keep milk records and pay greater attention to the feeding and treatment of his dairy stock. A striking instance of what can be done by milk recording and by selection of the best milkers is afforded by the performance of Mr. J. S. Struthers' dairy herd. Mr. Struthers, whose farm is near Sinoia, has been recording the milk produced by his cows for the last eight years, and has raised the average from approximately one gallon per cow per day to almost three gallons. During a recent visit of the Dairy Expert to Mr. Struthers' farm the total milk from 25 cows was weighed and measured. The total produced in one day from these cows amounted to seventy gallons, an average of almost three gallons per cow per day. Many of these cows, however, were far advanced in lactation, and thus the inclusion of their milk in the total milk produced tended to lower the average. Mr. Struthers has several cows which under ordinary conditions and without excessive feeding produce as much as five gallons of milk per day.

We shall publish periodically the milk records sent in, but we trust that a greater number of dairy farmers will respond to the invitation to render returns, for the list at the present time is by no means a representative one.

Fruit-growers' Exchange of South Africa, Ltd.—The formation of a South African fruit exchange, to which our readers will have seen references in the Press, is a matter of the greatest importance to the fruit-growers of this Territory. The decision to form the Exchange was taken at a representative meeting of fruit-growers and others connected with the industry held in Johannesburg on the 15th

September last. A verbatim report of the proceedings was printed in the *South African Fruit-grower and Smallholder* for October, and we would advise all interested to read it. The outcome of the meeting was the appointment of a provisional executive committee to which was entrusted the work of organising the Exchange. The Central or Fruit-growers' Exchange of South Africa, Ltd., will be constituted as follows:—

Local co-operative associations are being formed, of which there are already fourteen, more than sufficient to enable registration of the Exchange. One representative from each of these co-operative associations will form the general meeting of fruit-growers, which will be held once a year to decide on the general policy of the Exchange. From this body a Board of nine directors will be elected to carry on the general duties of the Exchange, which will be managed by this Board through a General Manager. District exchanges will be established in order to co-ordinate the work in different parts of the country under the Central Exchange.

The chief work of the Central Exchange will be to organise the various parts of the country and to co-ordinate the work, as well as to deal with such important matters as shipping and rail transit. Mr. A. G. Turner, the citrus adviser of this Department, is a member of the provisional executive committee, and it is his intention to call a meeting in Salisbury of those interested in citrus growing for the purpose of forming a district association to represent Southern Rhodesia. This meeting will be convened after the Exchange has been registered, which by the time these notes appear will probably have been effected.

The essence of such a movement is co-operation, and the time would appear to be ripe for its practical application. During ten months of 1921 no less than 259,216 boxes of citrus fruits were exported overseas, 390,861 boxes of deciduous fruits and 106,949 boxes of grapes, and there is every reason to expect a large expansion of this trade. In 1920 some 210,000 boxes of oranges were exported from South African ports, of which quantity Rhodesia sent about 20,000 boxes. It will be obvious then that co-ordination of effort is necessary if the best results are to be obtained.

The Exchange will work on much the same lines as the California Fruit-growers' Exchange, which Mr. Turner described in this *Journal* of April, 1921. For the present the Exchange will concern itself principally with obtaining shipping space, rail freight and the purchase of boxes and other materials for members. The appointment of a General Manager will be made shortly. Sums of money sufficient to cover initial expenses have been guaranteed, but it is proposed to maintain the organisation of the Exchange by a levy on the fruit exported, and a Bill to legalise this charge will be presented to the Union Parliament. For this year the provisional Board has decided to fix the amount of the levy at 5s. per ton of 40 cubic feet, and this will take effect at once for the deciduous fruit. The Government has promised to collect the levy money and to hand it over to the Exchange.

The scheme is supported by many influential gentlemen in the south, including Sir Percy Fitzpatrick, who has for many years taken a keen interest in the citrus industry, and Mr. Pickstone, the well known grower, and there is every prospect of the Exchange being successfully launched. We as a citrus exporting country are much interested in the formation of the Exchange, and it may be the wish of growers here that Rhodesia should be identified with the scheme.

A History of Stock Diseases in Southern Rhodesia.—We publish in this issue the first instalment of a history of the infective diseases amongst the domestic animals of Southern Rhodesia, written by Mr. J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon of this Territory. The history covers the period since the occupation of Mashonaland in 1890, and coming from such an authoritative source will, we are sure, be read with great interest. Mr. Sinclair came to Rhodesia in 1899, and since that time has had to deal with all the diseases enumerated, with the exception of rinderpest and foot and mouth disease. His responsibility has been a heavy one, and to him must be given the credit for the successful fight that has been waged. Mr. Sinclair's narrative will probably extend through the greater part of the current volume, and it is the intention at the end of the series to print the articles in one bulletin.

The instalment appearing in this issue deals with African coast fever and pleuro-pneumonia, and the following diseases will be dealt with in subsequent numbers:—Rinderpest, foot and mouth disease, anthrax, quarter-evil, tuberculosis, contagious abortion, three-day sickness, glanders, epizootic lymphangitis, pyæmia, horse-sickness, rabies.

Maize Yields.—According to a recent bulletin issued by the International Institute of Rome the area planted to maize in the United States of America in 1921 was 108,901,000 acres and the yield 892,080,000 bags of 200 lbs., or 8.19 bags per acre. The average acreage under maize for the period 1915-1919 was 106,552,000 and the yield 7.35 bags per acre. In Argentina in 1920 the acreage under maize was 8,090,100 and the yield 64,518,500 bags, or 7.96 bags per acre. In the period 1915-16 to 1919-20 the acreage planted to maize averaged 8,809,900 and the yield 5.15 bags per acre. In Southern Rhodesia, during the season 1920-21, 186,246 acres were planted to maize and the yield was 1,220,768 bags, or 6.55 bags per acre. America produces 75 per cent. of the maize of the world, and it will be of interest to know how this enormous crop is disposed of. The figures are given by Mr. Burt-Davy in the *South African Journal of Industries* for January, 1922. Mr. Burt-Davy places the crop at 820,000,000 bags a year, and states that of this total about 6½ per cent. (54,000,000 bags a year) is consumed by the manufacturing industries or is exported. Of this, about 14,000,000 bags are used in the starch

and glucose industries, 28,000,000 bags in the fermentation and milling industries, and 12,000,000 bags are exported. One firm of Chicago manufacturers alone uses every year over 10,000,000 bags for industrial purposes. This is poor-quality grain, mostly No. 4 grade, which otherwise would have almost no market value. Mr. Burt-Davy gives figures to show that the process of manufacture in the United States increased the value of the maize used by 100 per cent. Thus from 11,202,544 muid bags, worth, say, £5,000,000, the following products were obtained:—

	Weight.	Value.
Corn starch	534,537,409 lbs.	\$14,247,802
Glucose syrup	769,660,210 lbs.	17,922,514
Grape sugar	159,060,478 lbs.	3,620,816
Corn oil	8,164,175 lbs.	2,802,768
Stock food (from waste)		6,013,968
All other products		924,422
		\$45,532,290
		(say) £9,000,000

Over 90 per cent. of the maize crop in America, or about 766,000,000 bags, is used chiefly for feeding stock.

The Salisbury Show.—The annual show of the Rhodesian Agricultural and Horticultural Society will be held on the 8th, 9th and 10th August, and arrangements are well in hand for the compilation of the programme. Mr. G. R. Milne, who has always taken a keen interest in the affairs of the society, is the new chairman, and he is supported by a strong and representative committee. The show this year will occupy three full days and the exhibits will therefore remain on the grounds until the evening of the third day. This innovation is made to meet the wishes of many visitors to the show, who feel the need of having one clear day to devote to the inspection of the various exhibits. The committee are sparing no effort to make the show the success of previous years, and we feel sure that this important event will receive the support of farmers and the public in general.

Ground Nuts.—Mr. G. E. Askew, Avoca Farm, Bindura, states: "The crop of monkey nuts may be worthy of note, being nearly 29 bags to the acre. They were grown on good red soil (diorite), which had grown seven successive crops of maize previously. The land was given a fairly liberal dressing of kraal manure (8 to 10 tons per acre) and the nuts (Spanish bunch) were hand planted 30 inches between rows and 9 inches to 10 inches in row. Should like to hear if this return is exceptional."

The crop in question was 402 bags from 14 acres. So far as we are aware the record crop for Southern Rhodesia is 35 bags an acre grown (a) on the Salisbury Experiment Station, and (b) in the

Umtali district. This yield was, however, obtained from a very much smaller acreage. We should like to hear if any of our readers can beat Mr. Askew's figure.

Exportation of Plants, Seeds, etc.—Attention is directed to the "Destructive Insects and Pests Order, 1921," issued by the Ministry of Agriculture and Fisheries and published in the *Gazette* of 9th December. This Order prohibits the landing in England and Wales of certain plants, seeds, etc., unless each package or consignment has attached thereto a copy of a certificate issued at the time of packing by a duly authorised official of the country of export. Persons who wish to send to England and Wales consignments including any of the plants, seeds, etc., indicated in the order should take steps to ensure their inspection by a duly authorised official of the Agricultural Department, and obtain from him the requisite certificate. The following officials are authorised to grant the certificate in question:—The Chief Entomologist, the Collectors of Customs at Salisbury and Umtali, the Chief Customs Examining Officer at Bulawayo, and the officers in charge of Customs at Gwelo and Plumtree.

Rates for Barley.

The Beira and Mashonaland and Rhodesia Railways announce a reduction of the special rate on Rhodesian grown barley consigned to the Union. The revised rate is £2 per ton, and this applies to barley in full truck loads sent from any station between Umtali and Bulawayo (both inclusive) and stations on the intermediate branch lines to Mafeking. A minimum of 11 tons will apply to trucks which cannot be loaded to the full carrying capacity. The railway rate between Mafeking and Johannesburg is 17s. 8d. per ton, plus cartage, and the total rate will therefore be £2 17s. 8d. per ton.

A Short History of the Infective Diseases

AMONGST THE DOMESTIC ANIMALS OF SOUTHERN
RHODESIA SINCE THE OCCUPATION.

By J. M. SINCLAIR, M.R.C.V.S., Chief Veterinary Surgeon.

Although it is only a little over thirty-one years since the occupation of Mashonaland by the pioneers, followed a few years later by the conquest of Lobengula and the occupation of Matabeleland, the record of disease amongst the domestic animals is by no means a light one; indeed, no new country, so far as the writer is aware, has ever been subjected to two such cattle scourges as Rinderpest and African Coast Fever in one generation. Of other less destructive diseases we have had a fair share; some have disappeared, others are still with us, but on the whole the progress made in dealing with them is something which Rhodesians may be satisfied with. It is hoped that the following short history of these diseases, together with a brief account of the measures adopted for dealing with them, will prove interesting, not only to those of the pioneers and early settlers who are left, but also to those who have since arrived, and are now farming and ranching under more settled and favourable conditions.

AFRICAN COAST FEVER.

The introduction of African Coast Fever into Southern Rhodesia has frequently been attributed to the Australian cattle imported by Mr. Rhodes for re-stocking purposes, but it is now generally accepted that these animals died of redwater and gall-sickness, and that Coast Fever was introduced subsequently. The Australian cattle arrived at Beira about the end of 1900, and were detained there for some time because of washaways on the railway line. They suffered considerably at Beira from redwater, and their removal to Umtali did not improve matters; in fact, the mortality continued until three head only out of about 1,000 were left. It may be remarked here that two of the three survivors were subsequently sent to Salisbury, where they died from Coast Fever. At Umtali the Australian cattle were kept apart from other stock, and the heavy mortality was attributed to their inability to accommodate themselves to the climatic conditions in which they were placed; the real reason, however, was that they had come from non-redwater veld in Queensland, and were, therefore, particularly susceptible to redwater and gall-sickness.

During the latter part of 1901 some cattle were shipped at Dar-es-Salaam for Beira and Delagoa Bay. It is stated that these were the balance of a large mob brought down from the high veld in German East Africa to the coast, where the mortality was so heavy that the owners thought the only chance of saving any was to get them away by sea. It is alleged that on the passage to Beira a number died and were thrown overboard. About this time Mr. John Meikle, of Umtali, travelled from Beira to Delagoa Bay on a boat carrying cattle from Dar-es-Salaam. He states that he saw an animal suffering from what he then thought was redwater, but subsequently came to the conclusion that it was African Coast Fever. A certain number of these cattle were landed at Beira and forwarded by rail to Umtali, where some were disposed of to local butchers, and the remainder sent on to Salisbury. At both centres the animals were turned out to graze on the commonages, but no doubt all were soon slaughtered. Shortly afterwards local cattle began dying, but the mortality attracted no attention at the time, as it was by no means heavy at first, and was attributed to redwater and gall-sickness. It was not long, however, before cattle began dying at other centres and on the main transport roads, and by the end of the year (1902) the disease had been carried far and wide throughout the Territory, and eventually became established in the following districts, viz.: Umtali, Melsetter, Makoni, Inyanga, Marandellas, Salisbury, Mazoe, Lomagundi, Hartley, Charter, Gwelo, Chilizmanzi, Victoria, Gutu, Selukwe, Insiza, Belingwe, Umzingwane, Bulawayo, Bubi, Matobo and Gwanda. The extraordinarily rapid spread of infection in the first instance was largely due to a very heavy tick infestation and the ox-transport then on the road between Salisbury and Bulawayo.

It would serve no good purpose now to enter into details of the acute controversies which took place at this time as to the nature of the disease. The local veterinary authorities, supported by the Veterinary Bacteriologist to the Cape Government, held that it was an extremely virulent form of redwater or Texas fever, though differing in certain respects from the type of this affection known to them in the Cape Colony. This view was strenuously opposed by many stock-owners throughout the Territory, who insisted that it was an entirely new disease. As the infection was spreading so rapidly throughout the Territory, causing a mortality of 95 per cent. or more in herds attacked, the services of the late Professor Koch were secured in order to determine its nature, and, if possible, find a remedy. Dr. Koch arrived in Bulawayo in January, 1903, and on 26th March issued an interim report giving the results of his observations to that date. He concluded, *inter alia*, (1) that the disease was not redwater, (2) that it was similar to a disease which he had seen several years previously in East Africa, and (3) that it had been introduced *via* Beira and possibly carried from there to Umtali by the Australian cattle. Dr. Koch's remarks in this connection are as follows:—

“At the end of 1900 about 1,000 head of cattle for Rhodesia from New South Wales were landed at Beira, and because they could not be forwarded by rail at once they were sent on the veld for grazing there.

They grazed in the neighbourhood of Mr. Martini's farm and mixed with his stock, which were to all appearances in perfect health, and which remained so. Two or three weeks later the disease broke out amongst the Australian cattle, which were then sent to Umtali, and carried the disease with them.

"But how could the Australian cattle become infected? In New South Wales no such disease is known, and no mortality occurred amongst these animals during their voyage from Australia. There was also no apparent disease at Beira.

"The problem would be well-nigh insoluble if there was not one piece of evidence in our possession which I became cognisant of some years back, namely, that the same disease exists on the East African coast as has now broken out in Rhodesia, and that in German East Africa the disease was carried inland in a similar manner to that in which it may have been brought from Beira to Umtali.

"The stock on the coast of German East Africa are apparently quite healthy and in the best condition, but as soon as other cattle are brought there from clean districts, for instance, from the inner parts of the country, and graze on veld on which the cattle from the coast have been grazing, these imported animals will get sick and almost all die."

Dr. Koch assumed that the Australian cattle had died from the disease which he was then investigating at Bulawayo, viz. African Coast Fever. He was not aware that about November, 1901, twelve months after the arrival of the Australian cattle, some cattle had actually arrived at Beira from Dar-es-Salaam, and were forwarded to Umtali and Salisbury; that these cattle had been brought from the high veld in German East Africa, and were shipped because of the heavy mortality amongst them at Dar-es-Salaam. It is certain that the cause of the mortality amongst these cattle at Dar-es-Salaam was the disease referred to in the last two paragraphs of the above quotation, viz., that now known as African or East Coast Fever.

In support of the view that Coast Fever was introduced directly into this Territory by cattle from East Africa, the following remarks from the report of Dr. Koch already referred to regarding its introduction into the Transvaal may be quoted:—

"I am of opinion that there is also good reason for supposing that the infected area extends still further south to Delagoa Bay, as for some time past the Transvaal has been invaded from its south-eastern border by a slowly spreading disease infecting cattle, which appears from all accounts to be very much like the Rhodesian fever. Mr. Theiler, Government Veterinary Bacteriologist, Pretoria, whom I asked to send me some blood preparations from infected parts of the Transvaal, most kindly complied with my request, and we have been able to prove that in the preparations from different parts of the Transvaal (from Nelspruit, Herdepoort and Mooi Plaatz) exactly the same blood parasites are to be found as are present in the blood of animals affected with local Rhodesian fever; therefore, there can be no doubt that the same disease exists in the Transvaal as that prevailing in Rhodesia,

but when we take into consideration the position of the infected districts of the Transvaal, and the obstacles to communication which have existed and still exist, the view that the disease extended thither from Rhodesia is, I think, quite untenable. What is very likely, however, is that the disease obtained a foothold in the Transvaal in much the same way as it did in Rhodesia, that is by being imported from the coast, in the one instance from Beira, and in the other from Delagoa Bay. In appearance in Rhodesia the disease has conformed to a natural law which it has often followed aforetime. It has been brought inland from the infected coast districts, as it has previously been in many other instances, and therefore it appears to me more reasonable to call it 'African Coast Fever' in preference to calling it 'Rhodesian Fever.' "

The losses during the two years following the introduction of the disease were very heavy—it was estimated that over 19,000 head died. It is probable that the actual number was greater than this, as there was then no regular system of inspection and no obligation on cattle-owners to report the actual number of deaths. During this period the disease was almost entirely confined to cattle owned by Europeans. At 1st April, 1904, the total number of European-owned cattle was 30,369 head, and if the natural increase is taken into consideration it may be assumed that nearly half the European-owned cattle succumbed.

The following table shows the mortality year by year, and the number of outbreaks annually from 1907. The figures for the years 1903 to 1907 (a) inclusive are for the twelve months ending 31st March, and the remainder for the twelve months ending 31st December.

	No. of outbreaks.	Mortality.
1903	—	15,770
1904	—	3,500
1905	—	955
1906	—	732
1907 (a)	—	345
1907 (9 months)	7	152
1908	4	290
1909	7	196
1910	18	347
1911	8	1,046
1912	5	515
1913	6	172
1914	5	199
1915	35	1,174
1916	20	382
1917	13	438
1918	5	374
1919	8	798
1920	3	765
1921	1	191

As the result of Professor Koch's experiments and observations at Bulawayo he recommended a system of preventive inoculation, which consisted of the treatment of susceptible animals by the intravenous

injection of 5 cc. of defibrinated blood, taken from animals which had recovered from the disease, and repeated at intervals of fourteen days for a period of four or five months. This method was given an extensive trial in the Victoria and Bulawayo districts, and also in the Transvaal, but unfortunately the results did not come up to expectations. It was found that no immunity whatever was established, that clean inoculated herds offered neither more nor less resistance to infection than uninoculated herds when the disease appeared amongst them, whilst the mortality in such herds was nowise reduced.

The failure of Koch's system of inoculation was a great disappointment to cattle owners here, in the Transvaal and Natal, and also to the various Administrations concerned. There appeared no way out of the difficulties which we found ourselves in. Practically all the main roads in the Territory were infected, many farms adjacent thereto and all commonages; the disease was still spreading slowly; the mortality was not so heavy, however, for the simple reason that most of the cattle on the roads and at the more thickly populated centres had died; calves born from the salted remnants of infected herds contracted the disease, and few recovered; the infection was thus being perpetuated from year to year. The knowledge of the actual mechanism of the transmission of the disease was unknown; in fact, there were no sound scientific data on which preventive measures could be based. Dipping was not successful, because the interval between immersions was too long. Many were pessimistic enough to believe that the disease would destroy all the cattle in the Territory, and that we would be compelled to build up salted herds. When it is considered that in countries where Coast Fever has been enzootic for long periods the annual mortality in calves is very heavy—as much as 70 per cent.—it is obvious that it would have taken several generations for the breeding of even moderate numbers of such salted animals. Fortunately, however, Messrs. Theiler (now Sir Arnold Theiler) and Stockman in the Transvaal, and Lounsbury in the Cape Colony, had been investigating the nature of the disease and its methods of dissemination, and at an early stage in their work demonstrated that infection was carried by *Rhipicephalus appendiculatus* (the brown tick), *R. Simus* (black-pitted tick), and later others of the same genus were implicated. Based on these observations, especially on the life histories of the ticks concerned, the temperature camp system of dealing with infected herds was evolved by the Natal Veterinary Department and immediately adopted here. This was the first practical step, based on scientific knowledge, towards dealing with the disease in a satisfactory manner. It is unnecessary at this stage to enter into details of the working of this system; suffice it to say that it was practised for several years with good results. It is true that heavy losses occurred at times through the destruction of animals showing a rise of temperature, but on the other hand many thousands of cattle were saved which would assuredly have died from natural infection.

The next advance, and probably the most important discovery made so far, or likely to be made as far as dealing with and eradicating Coast Fever infection is concerned, was the work done by Watkins-Pitchford,

Government Bacteriologist in Natal. The results of his investigations were published in 1909-10 under the heading of "Dipping and Tick-destroying Agents," and clearly demonstrated that Coast Fever could be controlled and infection eradicated by dipping all cattle involved at intervals of 72 hours. His observations and conclusions have stood the test of over ten years' hard experience now, and on them is based the only satisfactory method of dealing with Coast Fever. This discovery was most opportune, because at that time the temperature camp system was becoming difficult to operate owing to increased settlement reducing one factor essential for its success, viz., sufficient clean and unoccupied veld to which the infected herds could be moved.

In August, 1904, the "Animals Diseases Consolidation Ordinance" was promulgated. By it the existing Ordinances and High Commissioner Proclamations dealing with the diseases of stock were repealed. Their essential provisions were, of course, embodied in the new Ordinance, and wide and ample powers provided for dealing with any existing diseases and others likely to appear or be introduced from adjoining territories. Shortly after the promulgation of this Ordinance regulations were published under its authority for the express purpose of dealing with African Coast Fever, or rather for controlling cattle movements, with the object of assisting in preventing the spread of Coast Fever infection in the province of Matabeleland. These regulations provided for (1) the prohibition of importation of cattle into Matabeleland for any purpose from beyond the border of Southern Rhodesia; (2) the movement of slaughter cattle to consuming centres, and control of same on arrival at such centres; (3) the movement of cattle required for milk supplies to Bulawayo and adjoining townships, such cattle to be confined in an enclosed paddock or stable from date of arrival; (4) the movement of working cattle (transport) within a radius of six miles of working mines. As the Bulalima-Mangwe district had not been invaded by Coast Fever, special provision for ox-transport therein was made. The effect of these regulations was the almost complete stoppage of cattle movements in the greater part of the province, except those required at the large centres for food supplies. In January, 1905, regulations on similar lines were promulgated for the province of Mashonaland. Shortly afterwards power was obtained to compel the enclosure of all calves born at the large centres or areas of common grazing. This provision was applied to the commonage at Salisbury, Bulawayo, Gwelo, Selukwe, Umtali and Gwanda, where infection was being perpetuated from year to year by calves, and resulted in the complete eradication of infection from each of these centres. In most cases the calves were moved out to clean farms after weaning.

These regulations seem very drastic compared to those now in force, but they were instituted at the urgent request of the majority of cattle owners in both provinces. The fact was that those who had any cattle left were willing to undergo any hardship or restriction in an effort to save them. Various alterations and amendments were made in the regulations from time to time, as new or altered conditions required, and in 1910 they were unified and made applicable to the whole Territory. It is needless to say that but for this co-operation of the cattle-owners of

the Territory generally, it would not have been possible to administer these regulations with any degree of success, and there is no doubt they have assisted to a very large extent in controlling and restricting the spread of infection.

As a contrast to the hopeless position which we were faced with in dealing or attempting to deal with Coast Fever during the first few years of its existence, the history and method of dealing with the last fresh outbreak, in fact the only one during 1921, may be quoted:— In December, 1920, two oxen strayed from the farm Vimbi in Matobo district. Impounded at Plumtree, they were released early in January, and a permit issued for their return to Vimbi. Instead of being driven by the route defined on the permit, they were taken direct, and *en route* passed through an infected area. About four weeks after arrival at Vimbi both died from Coast Fever. The Vimbi cattle, over 300 head, had been dipped regularly at a tank on an adjoining farm, together with various other lots, well over 1,000 head in all. The dipping interval was reduced to three days, and all cattle involved were dipped at the common tank. A cattle inspector was placed at Vimbi to keep the cattle there and on all adjoining farms under close observation, a police cordon was placed round Vimbi, the work of erecting a fence and a dipping tank was put in hand at once and completed in a few weeks. There has been no further case of disease amongst any of the cattle directly or indirectly involved.

PLEURO-PNEUMONIA: CONTAGIOUS LUNG-SICKNESS OF CATTLE.

As far as I am aware the exact history of the introduction of lung-sickness into Rhodesia has not hitherto been recorded, and I am fortunate in being able to publish the following account of such introduction, specially written for me by the late Rev. J. S. Moffat a few months before his death. Although this deals with an outbreak of disease before the occupation, the matter is of considerable historical importance and well worthy of record, being a first-hand account by, probably, the last survivor of the Europeans present in Matabeleland at that period:—

“When I first went to Rhodesia—then Matabeleland—it was in 1859, Umziligaas, the father of Lobengula, was then the chief. On the southern side the people were completely isolated from any neighbours. They had migrated from the south after their collision with the emigrant Boers who were gradually occupying what is now the Transvaal. There was an interval of about 200 miles of uninhabited country between the northernmost Bechwana tribe—the Bamangwato—and the first outposts of the Matabele, which were not very far from the Tati River. We were a party of four missionaries, Messrs. Sykes, Thomas and myself, accompanied by my father, who had known the chief, and was going to introduce us to him, having come to an understanding with him two years earlier. There were also two ladies in the party. We were, of course, travelling in the old style with ox wagons. At that time the one cattle epidemic was ‘lung-sickness,’ and it had pretty

well extended over the whole of European South Africa. Our oxen were all 'salted,' to use the term in vogue then, that is, they had all come through the disease and recovered, or they had been inoculated. We had occasion, however, to buy a few from the Bechwanas to replenish our teams as we passed through their country. When we were still two or three days distant from the first Matabele outpost we discovered a case of lung-sickness among these new cattle. We knew that the disease had not yet reached Matabeleland, and it was of paramount importance that we should not be the cause of its introduction; so we called a halt at once, and, having slaughtered the sick beast, inoculated all the new cattle and remained stationary until we were satisfied that the danger was past. Not content with this, on our arrival at the first village of the Matabele, my father sent on a message to the chief telling him of our arrival, and that we did not wish to go on with our own cattle, and would prefer to leave them in quarantine on the outskirts of the country, and we looked to him for the means of proceeding. His headquarters were at Inyati, 120 miles further, and our negotiations took a considerable time. At first he demurred to this arrangement, but we persisted. We knew that he had trek oxen of his own, which had been trained for him by a Boer who had visited him previously. At length he agreed and sent men to take charge of our oxen at a spot out of touch with any of the kraals, where they were kept a whole year in quarantine. Instead of sending his own oxen he sent men, a couple of hundred, to drag the wagons. It was hard work, but he provided for them in royal style; several bullocks were slaughtered every night at the bivouac, and orders were given to the villages near which we passed to supply beer *ad lib*. All the same, progress was slow, only a few miles a day, and at last he sent his own oxen, and in time we reached his camp; for he was also rustivating at the time some distance down along the Impembezi (Bembezi) River. I have mentioned all these particulars to show what care we took to avoid the risk of introducing the disease into the country, and we never grudged the delay or the trouble involved.

"For a couple of years all went well. We were the only Europeans resident in the country. There were one or two traders who used to pay an annual visit, but never remained more than two or three months. The country simply swarmed with cattle. At the time of the annual feast and dance, each regiment used to come up to headquarters and brought with it a troop of bullocks. These were collected at night and slept in the great kraal, by which I mean the enclosure formed by the double ring of huts which composed the town. My colleagues and I took the opportunity one morning to post ourselves at each of the three gates and to count the bullocks as they filed out; the result was that we found that 4,000 bullocks had slept in the kraal that night. A liberal percentage of these would be slaughtered for the purposes of the feast, and then the different regiments would disperse with their cattle to their own homes. Yet, after all, these were only a small part of the cattle of the country, for only a select troop of bullocks were brought up to headquarters; none of the cows or young animals. It was not difficult to identify the breeds. There was a considerable portion of

Boer-Africans, which were the descendants of booty taken in their wars with the emigrant farmers. The bulk were the ordinary long-horned breeds, such as used to be the prevailing type of native cattle. The cattle of the Mashona to the north and east of the Matabele were much smaller, with a tendency to a hump between the shoulders, and were not much valued by the Matabele, whose vassals the Mashona were. After two years a trader from the south prevailed upon the chief to let him come in with his own oxen. He had not been long at headquarters before he discovered that one of his bullocks had developed lung-sickness. He tried to hush it up, had the animal killed and made away with in the veld, but the mischief was done; the disease had started. He and the other traders got out of the country as quickly as possible. Some of the cows we had acquired had caught the disease, and we proceeded to inoculate. The people, seeing this, begged us to help them in the same way. They had no faith in their own competency, and we were beset with applications on all sides. For the next six months Messrs. Sykes and Thomas and I did little else than inoculate. It did not occur to us to keep an account of the numbers, but they must have been many thousands, and these we were able to save, but in the meantime a far greater number were swept away.

"The procedure was simple enough. A fresh animal which had only recently sickened was killed, and the lung with the serum which it had begun to secrete was put into a wooden bowl. We happened to have large quantities of yarn; this dipped into the serum was run through the skin of the tail with a sail needle, so that there was no time lost. The freshness of the serum obviated any tendency to abnormal swelling of the tail, which was so troublesome in cases where the lung of an animal was used that had been far advanced in sickness, or where the lung had been kept too long."

From the above it is evident that lung-sickness affected the Matabele cattle in epizootic form, causing heavy losses, and it may be concluded that subsequently it assumed less formidable proportions, aided, no doubt, by the system of inoculation instituted by Mr. Moffat and his fellow-missionaries. Although the disease was in evidence during the years between the occupation and the arrival of rinderpest, it does not seem to have caused much comment, due probably to the fact that most of the cattle then owned by Europeans were employed for transport purposes, and these, as a rule, had been exposed to infection at some time or other and inoculated several times. After rinderpest little was heard of lung-sickness until 1900, when a large number of outbreaks occurred in the vicinity of Bulawayo, where military movements, in the course of which infected cattle were sometimes employed, may have been responsible for its dissemination, though undoubtedly far more harm was done by speculators, who purchased infected stock in the south and sold them indiscriminately to farmers and transport riders. From Bulawayo the disease extended along the main transport routes to Gwanda, Gwelo, Enkeldoorn and Charter; outbreaks also occurred in the Marandellas and Melsetter districts. The rest of the Territory appears to have been fairly clean at this period.

In 1900 an Ordinance "To provide for the better suppression of

the disease called Lung-sickness in cattle" was passed by the Legislative Council. This gave the officials concerned power to destroy all infected animals and to compel the inoculation of all in-contacts. It also provided that the vendor of cattle, whether sold privately or publicly, should be deemed to have warranted all cattle sold to be free from lung-sickness, and in the event of the disease appearing within 14 days of date of sale, he might be sued for restitution of the price paid for diseased animals.

In his Annual Report for the year ending 31st March, 1902, the then Chief Veterinary Surgeon, Mr. C. E. Gray, wrote as follows:—

"The past year has been characterised, from a stock-owner's point of view, first, by an unusual prevalence of lung-sickness, and second, by the present outbreak of redwater in the Umtali and Salisbury districts, which has, during the last month, assumed almost epidemic proportions.

"The animals responsible for the dissemination of lung-sickness were mainly loot cattle purchased at Mafeking and drawn from various parts of the Transvaal, where this disease has been peculiarly rife, military movements preventing anything like a systematic attempt to stamp it out. Cattle of this class were sold at low prices, and being bought and brought up to Bulawayo by speculators, they were distributed widely throughout this colony, and almost everywhere outbreaks of lung-sickness followed their distribution.

"After the Orange River Colony and Transvaal were closed on account of rinderpest, the case was subsequently aggravated by the introduction of a highly susceptible class of animals drawn mainly from Barotseland, a country where lung-sickness has been practically unknown, and whenever these cattle came in contact with infection, the outbreak was marked by a high death rate, both from the disease and subsequently from inoculation, for it has been found that such stock re-act very severely when inoculated.

"All through the summer months lung-sickness has been prevalent, one outbreak succeeding another with discouraging promptitude, and to the temporary suspension of compulsory slaughter in the Bulawayo district much of the sickness in other parts of the country has been due, as animals which 'salted' in Bulawayo were disposed of and sent to other districts by owners sagacious enough to appreciate the danger of keeping such stock."

During the year 1902-3 a few outbreaks occurred, and the following year an outbreak occurred in Marandellas district, and a suspected case was reported from Belingwe. In 1912 a suspected case occurred on a farm in Plumtree district adjoining the Tati Concessions. The writer examined the lungs and formed the opinion that pleuro-pneumonia existed, which opinion was subsequently confirmed by Mr. W. Robertson, then Director of the Veterinary Laboratory, Grahamstown. No further cases occurred, and it would now seem that the diagnosis was incorrect, as it is highly improbable that a solitary case could occur in a herd of susceptible cattle. It may be said, therefore, that Southern Rhodesia has been free from pleuro-pneumonia since 1904.

In view of the fact that pleuro-pneumonia is regarded as the most difficult of all bovine diseases to eradicate unless the "stamping out" policy is adopted, the question is frequently asked as to how it was eradicated in this Territory. The application of the laws and regulations promulgated in 1900 did undoubtedly effect something in controlling and ultimately reducing the incidence of the disease, but there is no doubt that its final disappearance was due to the destruction of all "lungers" by African Coast Fever, a marvellously fortuitous occurrence certainly, but the only possible explanation.

(To be continued.)

Redwater and Gall-Sickness Vaccine.

It is hereby notified that from 1st February, 1922, the price of redwater and gall-sickness vaccine will be 2s. 6d. per dose.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

The Velvet Bean.

By J. A. T. WALTERS, B.A., Agriculturist.

The velvet bean is, without exception, at the present time, the most important leguminous crop native to, or introduced into, Rhodesia. The plant thrives under the climatic conditions obtaining in this country, and, as a rule, makes exceedingly satisfactory growth on all classes of soil. Twelve years of experimental trials with the velvet bean have proved its suitability to every settled district of the Territory, and with it crop failure is practically unknown wherever it has been tried. It seeds freely, although requiring a full season to come to complete maturity. The copious growth of vine, leaf and beans above ground is palatable and nutritious as a stock feed, and its extensive root system provides a liberal supply of organic matter and nitrogen, which enriches the soil when ploughed under after harvest. Its freedom from pests and resistance to disease are among its remarkable features. When it is realised that prominent leguminous crops of world-wide importance, such as lucerne, clover and even cowpeas, have failed to prove satisfactory except to a very limited extent, it will be appreciated at once that the velvet bean assumes a position of supreme agricultural importance in Rhodesia. In fact, the place of the clover in Europe and of the cowpea in America is equally well filled by the velvet bean in this country.

History.—The velvet bean, unlike most members of the bean family, is comparatively new to agriculture. Bailey states that it is a native of India, and was only introduced into America about 1877. Its great value was immediately recognised, its principal drawback being the long season required for maturity. With the introduction and development of short season varieties, a great impetus was given to its culture. In 1916 the crop of beans in America reached such large proportions that numerous mills found it profitable to manufacture velvet bean meal, prepared by grinding the dry ripe pods and seeds. The lines along which improvement in this crop was effected include earliness in maturity and freedom from stinging hairs. The first variety grown in this country was the Florida bean, but since then many of the improved varieties have been introduced and tried at the agricultural experiment station, Salisbury, during the last ten years, under such names as Lyon bean, Yokohama bean, Chinese bean, etc., all of which are reputed to be early varieties. The only new variety, however, that has so far warranted propagation on a large scale, as a result of these

trials, has been the White Stingless variety, which has the advantage implied in its name of being free of the stinging hairs on pods and leaves, which are characteristic of the Florida bean.

The origin of this White Stingless variety is not fully known. It was first brought to the notice of this Department about 1913 by Mr. Bovill, of Bromley, and by Messrs. Laing Bros., of Figtree. From then on these gentlemen would appear to have grown it on their farms on a small scale. On the Government Experiment Stations it was each year grown more extensively, and from these sowings seed was raised for free issue and for sale to farmers in all parts of the Territory. The precise source of Mr. Bovill's and Messrs. Laing Bros.' original seed is uncertain, but in both cases it would seem to have reached them through natives living near their farms. Be this as it may, the crop as now grown in Rhodesia owes its introduction to the action of the gentlemen in question in bringing this bean to the notice of the Agricultural Department. Its well deserved and increasing popularity is largely attributable to the free issue of seed for co-operative experiments, whereby its valuable properties have been made known.

Botanical.—The velvet bean used to be known botanically as *Mucuna utilis*. Recent American research has shown, however, that the velvet bean of commerce is not identical with the plant originally described as *Mucuna utilis*, and that it must be placed under the genus *Stizolobium*. Mr. C. V. Piper, Agrostologist to the U.S.A. Department of Agriculture, in a fairly complete monograph on the "Florida velvet bean and related plants," definitely separates eight species, and assigns the specific name "deeringianum" to the velvet bean, which thus becomes *Stizolobium deeringianum* under the new nomenclature. It is not yet known whether the White Stingless variety at present grown in Rhodesia is a distinct species, or is only a variety of the Florida. It may be distinguished in the field by its white or light mauve flowers, whereas the flowers of the Florida variety are uniformly dark mauve in colour. It might here be stated that at least one species of *Mucuna*, viz., *M. coriacea*, is native to Rhodesia. It is marked by having pods with very long golden hairs, which are excessively stinging, so much so that it is commonly known as the "Buffalo bean," or in Dutch as 'brand boentje' (fire bean). Another bean closely related to the velvet bean has been recently received from Shamva and is now under observation.

Cultural.—The methods of cultivation employed with this crop necessarily have reference to the running and climbing habits of the plant. The vines attain a great length, and when the seeds are sown at the same distance as for maize, viz., approximately 40 in. by 15 in., the runners completely cover the ground with a dense growth of green vine and foliage capable of yielding up to two or three tons of dried hay per acre. Planting is usually done with the maize planter and at the above distances apart; 15 to 20 lbs. of seed is required per acre. On granite soils a thicker planting is advocated at the rate of 20 to 30 lbs. per acre. The crop thrives in a variety of soils, ranging from

thin sandy to heavy chocolate; low lying soils which are apt to become water-logged should be avoided, as the dense surface of foliage prevents the free circulation of air, and this results in rotting. Land intended for this crop should be prepared as for maize, but less after-cultivation will be necessary, as the vigorous growth of vines tends to keep down the weeds and makes cultivation in the later stages unnecessary and indeed impossible. The Florida and White Stingless varieties are both long season crops, requiring about five months to come to maturity. For a hay crop and for seed production it is consequently advisable to plant early in the season, from the middle of November to the middle of December. For ensilage purposes sowing may be later if required, or if planted alternately with maize the seed may be sown at the same time as the maize. The practice of planting maize and velvet beans together for ensilage is an excellent one, giving an increased weight of green fodder per acre and a higher feeding value in the mixture. Experiments have been conducted to ascertain whether the two crops should be sown simultaneously or otherwise, and the results seem to indicate that sowing both simultaneously or at an interval from 7 to 14 days between the crops is satisfactory. The advantage of sowing the maize before the bean is that a sturdy support is thus provided for the twining vines. The interval between both plantings should, however, not exceed a fortnight. Trials with a view to growing velvet beans and maize together both *for grain* and under the same conditions have been successfully made at the agricultural experiment station, Salisbury, the beans and maize being sown alternately at a distance of 15 inches in the rows, there being thus half a stand of each. Both were planted simultaneously on the 25th November, 1920, and resulted in a yield of 2,862 lbs. of maize, together with 576 lbs. of velvet beans per acre. This was after a very exhausting crop of buckwheat the previous season. It would thus appear that velvet bean and maize may be grown conjointly with advantage to both, and with resulting benefit to the soil. The best methods of combining the two have yet to be determined, but the following extract from a bulletin published by the Mississippi agricultural experiment station indicates the conclusions arrived at there, and will suggest lines along which trials can be profitably conducted by the individual farmer.

"In order that velvet beans may fruit well they must be planted with some crop that will support them. Maize is the crop almost entirely used for this purpose, as it has been found that the beans interfered very little with the yield of the maize. On the other hand, they leave large quantities of decaying vegetable matter on the land, which will largely increase the humus and nitrogen content of the soil. This leads to heavier yields of maize in later years. The writer, after fifteen years' experience in growing maize and velvet beans, has come to the conclusion that the most satisfactory method is to plant either alternate rows of maize and beans or two rows of maize to one of beans, planting the beans a few weeks later than the maize."

When the two crops are grown together, both for grain, there is the additional advantage of providing a pasture, after the grain has been harvested, of considerably more value than maize stalks alone.

Yields and Harvesting.—The velvet bean is grown in Rhodesia for hay, seed and green fodder for ensilage. Its value as a stock feed is bound up with the fact that, being a leguminous crop, it is high in protein content, this being as high as 14 per cent. in good velvet bean hay. In this respect it is only excelled by vetch hay (17 per cent.), cowpea hay (16.6 per cent.), soybean hay (15.4 per cent.) and lucerne hay (14.3 per cent.). The harvesting and curing of this crop into hay is far from being an easy matter. On account of the intertwining of the vines it is almost invariably cut by hand, and as the vines take a longer time to dry than the leaves, there is always a considerable loss of the latter. As little handling as possible in this operation is recommended, and it may be added that for good hay the vines need not be dried excessively, the presence of a certain amount of moisture leading to a slight fermentation which improves the quality of the hay, as in the case of lucerne. After cutting, the hay should be allowed to remain spread on the ground for a day or two until the leaves have dried out, after which it can be gathered into moderately large cocks to enable the stalks to dry out. This in favourable weather will take from 7 to 14 days. In this way excessive bleaching and loss of leaf will be avoided. Green weights taken at the agricultural experiment station, Salisbury, show a yield of about $6\frac{1}{2}$ tons to the acre. This usually dries out to about $1\frac{1}{2}$ to 2 tons of hay. Careful handling will increase both the quantity and quality of the hay, while adverse conditions may very materially reduce it. When grown for seed principally the crop is allowed to attain full maturity. Under such conditions the weight of seed obtainable is a very considerable one. Four separate experiments at Salisbury in 1920-21 showed yields of 1,270 lbs., 1,210 lbs., 1,116 lbs. and 880 lbs. per acre respectively. In two cases the pods and seeds were first weighed together, the seeds being subsequently weighed separately, with the following results:—

	Weight per acre.	
Pods and seeds	2,320 lbs.	1,600 lbs.
Seeds only	1,116 lbs.	880 lbs.

In America it is usual to feed the velvet bean, pod and all, either crushed or soaked for 24 hours, and the adjoining table giving an analysis of both shows that the practice is to be recommended:—

	Protein.	Fat.	Nitrogen, free extract (Starch, etc.).	Fibre.
Velvet bean meal (pod and seed) ...	18.0	4.0	48.0	14.0
Velvet bean seeds only	23.0	6.5	48.0	7.6

As a Soil Renovator.—It is, however, in respect of its qualities as a soil renovator that the velvet bean should make a special appeal to the Rhodesian farmer. In this respect experience has shown that it is unique, being superior for this purpose to any other plant of general agricultural utility in this country. This crop has been systematically employed at the agricultural experiment stations in experimental work as a rotation legume with maize, and the results as published from time to time should be very convincing. For this last season they are as follows:—



No. 1. Maize after oat stubble ploughed under. Experiment Station, Salisbury, 1919.



No. 2. Maize after velvet bean stubble ploughed under. Experiment Station, Salisbury, 1919.

Average yields of maize after :	Bags of maize per acre.
1. Green manuring with velvet beans previous season (3 plots)	25.5
2. Green manuring with velvet beans plus 1,500 lbs. lime previous season (3 plots)	25.5
3. Green manuring with velvet beans previous season (average of all plots)	26.4
4. No green manuring previous year (10 plots) ...	20.9

Analyses made by the Agricultural Chemist in 1921 show that when the velvet bean crop is ploughed under the material above ground (excluding the root system) contains the following quantities of plant food, calculated in percentages of the dry matter:—

Nitrogen.	Phosphoric oxide.	Potash.
3.0 per cent.	0.47 per cent.	1.7 per cent.

equal in a green crop of $6\frac{1}{2}$ tons per acre to the following total amounts of fertilising ingredients:—

Nitrogen.	Phosphoric oxide.	Potash.
191 lbs.	30 lbs.	108 lbs.

Except when grown solely as a green manure in general practice the top growth is removed, leaving only the root system to be incorporated in the soil, together with that portion of the foliage which has been lost in harvesting. Analyses and weights of the manurial value of the root system of velvet beans are not available for Rhodesia, but the average of a number of tests made in America gives the following results:—

Weight of dried roots per acre = 713 lbs.

Weight of nitrogen in roots from an acre ... = 8.4 lbs.

The advantage of ploughing in the whole crop after removing the hay is thus obvious. It may happen that the turning in of so heavy a crop of green material may fail to make its beneficial influence felt immediately, on account of the increase in soil acidity that is liable to result from this course. This seems to be illustrated by trials made with a number of crops at the agricultural experiment station in 1920-21, which resulted as follows:—

Yields of maize per acre after :	Bags.
1. Niger oil ploughed under	20.25
2. Niger oil, stubble only ploughed under	20.92
3. Sunn hemp ploughed under	18.75
4. Sunn hemp, stubble only ploughed under	23.0
5. Velvet beans ploughed under	26.5
6. Velvet beans, stubble only ploughed under	26.75

From this table it is evident that in certain cases the stubble alone gives results that compare favourably with the whole crop in the first year after application. It is more than likely that the benefit of ploughing in the whole crop will be more evident in succeeding years, and maize is being grown again on these plots to test this point.

Markets.—So comparatively new a crop as the velvet bean has not yet established itself in the leading markets of the world, and two factors militate against its obtaining a prominent place, viz., the fact that the bean cannot be used for human consumption, and that the crop can only be grown in certain restricted areas. Within those areas, however, it can be grown to perfection with a certainty that is denied to most other crops. This and its high value as a stock feed should ensure for this crop a sufficiently large output from Rhodesia and a correspondingly high price on the home markets to warrant an effort being made to obtain its recognition. Local seed prices vary from 25s. to 40s. a bag, the White Stingless commanding a higher price than the other, but the sales are usually confined to grain for seed purposes. Attempts to place velvet bean meal on the home markets are certainly worth a determined attempt, while in the Union of South Africa the bean meal should command a ready sale on account of its unique value in the feeding of beef and dairy cattle.

From what has been said, it is evident that the velvet bean deserves a prominent place in the farm economy of Southern Rhodesia. The ease with which it can be grown, its certainty as a crop, its value as a stock feed, and its utility as a soil renovator entitle it to rank with the leading leguminous crops of other countries. Where mixed farming is practised it is indispensable, and even on farms where grain crops are the primary consideration, its rotational and green manuring value and the possibility of marketing the seed entitle it to a prominent place.

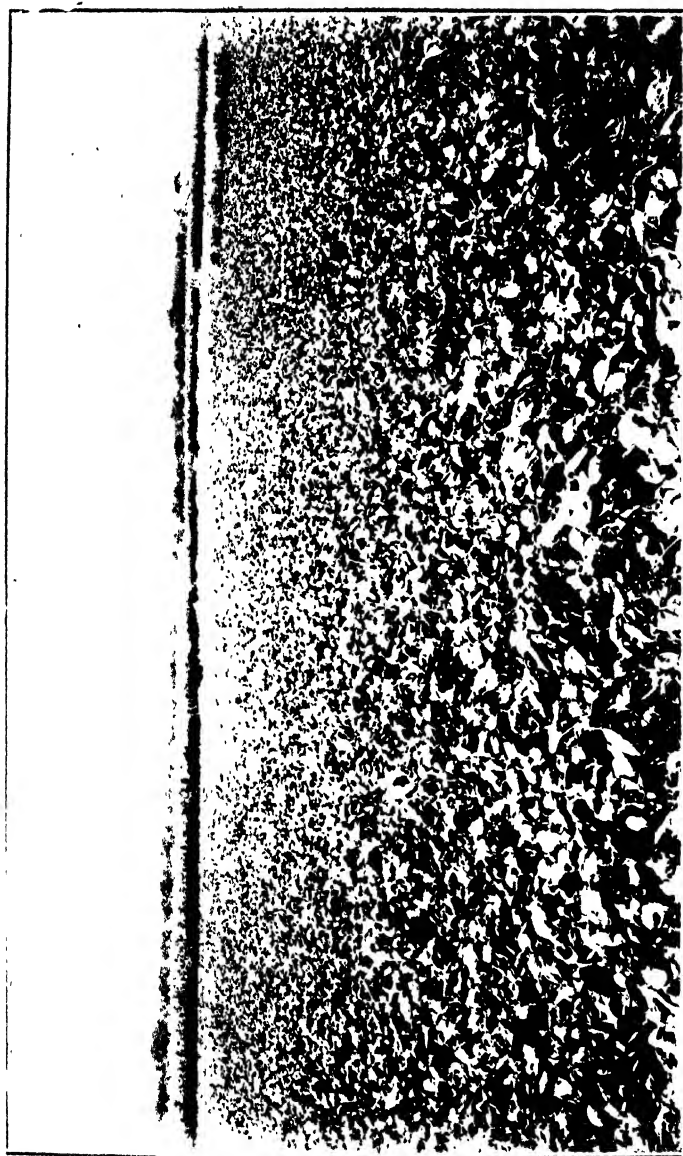
The following extracts from an article on Velvet Bean Feed, by J. B. Lindsey and C. L. Beals, of the Massachusetts Agricultural College, throw further light on the feeding value of the velvet bean as ascertained in America.

1. Velvet bean feed consists of the ground seeds and pods of the velvet bean, a leguminous plant grown quite largely in the Southern States.

2. In chemical composition it resembles wheat bran, but contains rather more fibre, due to the presence of the bean pods.

3. As a result of digestion studies it was found to contain about 130 pounds or 11.5 per cent. more digestible organic nutrients per ton than does wheat bran, and as a component of the dairy ration one would expect somewhat better results from its use.

4. Two feeding experiments were made with groups of six and four cows, in which the ration consisted of hay and a grain ration of 20 per cent. cotton seed meal, 40 per cent. corn feed meal, and 40 per cent. velvet bean feed or wheat bran. The results show that the cows while receiving the velvet bean ration produced 2.7 and 9 per cent., with an average of 5 per cent., more milk than while on the wheat bran ration. It seems safe, therefore, to conclude that the velvet bean feed is somewhat superior to wheat bran for dairy purposes.



A pure stand of velvet beans sown in rows 40 ins by 15 ins. Agricultural Experiment Station, Salisbury.



Maize and velvet beans for ensilage. Agricultural Experiment Station,
Salisbury.

5. It may constitute as high as 40 per cent. of a dairy ration, together with a like amount of corn or hominy meal or ground oats, and some 20 per cent. of cotton seed or linseed meal, or other high grade protein concentrate.

6. As a food for pigs a ration composed by weight of 50 parts corn feed meal, 40 parts velvet bean feed, and 10 parts digester tankage, or one composed of equal weights of corn feed meal and velvet bean feed, did not prove as satisfactory as one composed of 90 parts corn feed meal and 10 parts digester tankage; and so large an amount of the velvet bean feed is not recommended.

7. A ration composed by weight of 20 parts velvet bean feed, 20 parts high-grade peanut meal, 50 parts corn meal and 10 parts alfalfa meal gave as satisfactory results as one composed of 80 parts corn meal and 10 parts each of digester tankage and alfalfa meal; and such combinations are to be recommended.

8. The addition of 10 per cent. ground alfalfa to the grain ration for growing pigs, in order to supply the necessary vitamins, did not seem to exert any marked effect in promoting growth.

9. As a feed for horses, velvet bean feed, if sufficiently dry to prevent decomposition, may comprise some 20 per cent. of the grain ration, mixed together with 30 per cent. oats, 40 per cent. cracked corn and 10 per cent. wheat bran.

10. It is important that the velvet bean feed should be well dried before being shipped, otherwise more or less decomposition is likely to set in, and the feed proves unsatisfactory for use. The writer regards a satisfactory quality of velvet bean feed as a distinct addition to the protein concentrates at the disposal of northern feeders.

11. Velvet bean meal (beans minus the pods) would undoubtedly prove more satisfactory for pigs and horses.

WHAT VELVET BEAN FEED IS.

It is now becoming common to pick the best of the beans and use them without hulling for cattle, or hulled as a food for pigs. The former is termed velvet bean feed, and the latter velvet bean meal. Machinery has more recently been devised for drying and grinding the unhulled beans, and it is said that the industry is increasing rapidly. About a year since, more or less of the velvet bean feed was placed upon the Massachusetts market, but it did not seem to give the best of satisfaction, partly on account of the feeders' lack of familiarity with the product, and partly because of its being shipped in too moist a condition.

COMPOSITION OF VELVET BEAN FEED.

	Number of analyses.	Water.	Ash.	Protein.	Fibre.	Extract.	Fat.
Velvet bean feed	3	11.31	4.57	16.66	12.71	50.66	4.09
Wheat bran ... (for comparison)	116	10.00	6.20	16.10	10.00	53.30	4.40

DIGESTIBLE ORGANIC NUTRIENTS IN 2,000 POUNDS.

	Protein.	Fibre.	Extract Matter.	Fat.	Total.
Velvet Bean Feed ...	246.6	162.6	790.2	69.54	1268.94
Wheat Bran (for comparison)	248.0	78.0	756.8	55.40	1138.20

Velvet bean feed contains about the same amount of digestible protein as does wheat bran. Its content of digestible fibre, extract matter and fat is somewhat in excess of that contained in the bran, and on the basis of total digestible organic nutrients it is shown to have some 11.5 per cent. more feeding value than the latter feed.

Statistics of Crops Grown by Europeans in Southern Rhodesia

FOR THE SEASON 1920-21.

By H. C. K. FYN, Acting Statistician.

This report comprises the eighth annual report on agricultural statistics for the Territory of Southern Rhodesia.

From the information at our disposal the total number of individual farms and ranches beneficially occupied in the Territory is, at this date, 3,195. The Gwelo district heads the list with 302, followed by Hartley 298, Mazoe 292, Salisbury 220 and Lomagundi 200. A complete list forms one of the appendices to this report. Many of the farms are in groups under a single management, but each of these farms was enumerated. The total number of farmers and ranchers in Southern Rhodesia whose addresses have been recorded in the Directory of Farmers is 2,355, of which 202 are partnerships, companies or syndicates, enumerated singly. The names of many farmers who had recently taken up land and sundry others not recorded in our Directory of Farmers were received from the Police, whose assistance in this direction is much appreciated.

Although there is marked improvement as regards date when the majority of completed crop returns came in, there is still room for considerable improvement in this respect. Those farmers who were in default do not appear to realise their obligations, nor do they appear to recognise the importance to the country and to the public of statistics of production. The delay in sending in their returns was the cause of much extra work in preparing and sending out a large number of reminders on two occasions.

Included in this report are tables as follow, viz. . . .

1. Statistical statement of crops, 1920-21.
2. Districts in order of acreage of cultivated land.
3. Cultivated crops in order of area in 1920-21.
4. Acreage in relation to class of crop.
5. Number of farms and ranches by districts.

AREA UNDER CULTIVATION.

The total area under cultivation was 237,268 acres, an increase of 26,174 acres. The proportion of the total acreage allotted to cereals

was 82.9 per cent., leaving 17.1 per cent. for the other classes of crops. The following statement shows the percentages under the principal crops to the total area under cultivation, viz. :—

Maize	78.4 per cent.
Tobacco	4.0 „
Wheat	3.0 „
Maize (silage)	2.6 „
Ground nuts	1.8 „
Sunflower	1.6 „
Beans ... ..	.9 „
Potatoes ... ..	.8 „
Velvet beans ... ..	.8 „
Oats ... ..	.6 „
Pumpkins ... ..	.6 „
Cattle melons ... ..	.5 „
Teff grass ... ..	.4 „
Other crops	4.0 „
Total	100.0 „

Maize.—In March, 1921, a preliminary estimate of the maize crop was issued. This forecast was 1,000,000 bags from 182,500 acres. In July, 1921, the final estimate was issued, viz., 1,120,000 bags from 185,000 acres. The actual yield was 1,220,000 bags from 186,246 acres, or 6.55 bags per acre. This gross return, as also the acre yield, might possibly have been higher had not the maize beetle destroyed crops aggregating hundreds of acres in the Gwelo district and in parts of Chilimanzi, Victoria and Charter districts. The districts showing the highest yields are Mazoe, 633,926 bags (increase of 76,672); Salisbury, 189,199 bags (decrease of 8,173); Lomagundi, 139,412 bags (increase of 39,989); Hartley, 61,833 bags (decrease of 6,878), and Gwelo, 38,068 bags (decrease of 7,434). The Mazoe and Lomagundi districts alone accounted for the majority of the increase in the total yield.

Production of Maize, 1916-17 to 1920-21.

Season.	Acres.	Bags.	Yield per acre.
1916-17	203,150	938,130	4.62
1917-18	192,148	591,722	3.08
1918-19	173,313	889,969	5.13
1919-20	173,467	1,120,548	6.45
1920-21	186,246	1,220,768	6.55

The highest yields per acre are as follow, viz. :—

Mazoe	9.3 bags.
Darwin	8.0 „
Lomagundi	7.7 „
Salisbury	6.2 „

The remainder range from 5.4 bags to 1.6 bags per acre. The highest individual acre yield was 13.3 bags in the Sebungwe district.

Wheat.—It was found during the completion of the main returns, and on enquiry in certain quarters, that actually there is little if

any wheat grown during the summer months in Southern Rhodesia, and although many of the returns sent in showed the particulars for wheat under the heading of "grown in summer," this was not the case; these entries should have been made under "grown in winter, 1921." For this reason the acreage under wheat in 1921 is shown in a single column, and not in two columns as has been done hitherto.

The total area under wheat was 7,118 acres, and the estimated total yield 28,400 bags. The yield per acre over the whole country is estimated at 3.9 bags, the highest recorded since official returns of production were first collected in 1914. The actual yield cannot be given owing to the fact that at the time when most of the returns were despatched by the farmers the wheat was still standing on the land. In a few cases, however, the yield was given. The highest acre yield, viz., 10 to 14 bags, was obtained in several places in the Inyanga district.

The area devoted to wheat during the coming winter may well be far in advance of that recorded for the past season. A large local output of wheat would in all probability stabilise the market price, more especially if greater attention is devoted to growing a certain proportion of hard wheats. It may be of interest to give here the particulars of wheat and wheaten flour imported into Southern Rhodesia during the twelve months ended 31st October, 1921.

Wheat	2,224,908 lbs.,	valued at	£23,064
Wheaten flour and meal ...	6,185,425 lbs.,	valued at	97,592

£120,656

By the addition of 30 per cent. for bran to the second line the above quantities together would be represented by, roughly, 51,329 bags of wheat of 203 lbs. It is expected that this deficiency will be produced in the country within the next three years. The exports (probably to the north) of wheaten flour for the same period were: 446,023 lbs. valued at £9,825, representing 2,437 bags of flour of 183 lbs. at £4 per bag.

PRODUCTION OF WHEAT.

	Acres.	Estimated yield. Bags.	Bags per acre.
1917	4,655	15,425	3.3
1918	5,020	13,806	2.7
1919	4,394	13,432	3.0
1920	5,139	17,142	3.3
1921	7,118	28,400	3.9

Barley and Oats (for grain).—The production of good barley for malting purposes has received an impetus from the South African Breweries, who supplied seed and purchased the grain harvested at a fixed price. Some of the samples grown and forwarded to the Breweries and to this Department have been pronounced to be of excellent quality. The yield in some cases was as much as 10 to 12 bags per acre. Although the area given to "barley" is shown as 769 acres, it is probable that the most of this was planted for green fodder pur-

poses, and should have been returned under that heading. The same remark applies to oats. Only a small proportion of this crop is harvested for grain, the bulk being used, as oat-hay on the farm.

Tobacco.—The total area planted to tobacco, Virginian and Turkish, was 9,531 acres, of which the former had 7,888 acres allotted to it. The acre yields were: Virginian 404 lbs. and Turkish 337 lbs., compared with 435 lbs. and 266 lbs. respectively in 1920. The season opened unfavourably for the majority of tobacco growers. No rain fell just when it was most needed, and the late planted crops suffered from frost in consequence.

PRODUCTION OF TOBACCO, 1918-21.

Season.	Acres Virginian.	Acres Turkish.	Total acres.	Yield, Virginian.	Yield, Turkish.	Total yield.
1917-18	2,434	813	3,247	415,210	204,961	620,171
1918-19	3,198	999	4,197	1,179,932	287,680	1,467,612
1919-20	5,546	1,958	7,504	2,435,994	511,633	2,947,627
1920-21	7,888	1,643	9,531	3,192,662	554,320	3,746,982

Cotton.—Although the area under cotton is given as 802 acres, only a small proportion was allowed to mature, the remainder having been ploughed in during the earlier stages. Unless the demand for this commodity improves, it is unlikely that it will figure in future returns.

Kaffir Corn, Rupoko and Rice.—The acreage devoted to these crops is gradually advancing. These grains are mostly utilised on the farm and are not grown at present for market purposes.

Rye had 130 acres given to it. The yields were disappointing.

Pumpkins and Cattle Melons.—A footnote—"specify whether grown with maize or separately"—was added to the 1920 return forms in order to ascertain as far as possible the acreage actually planted to pumpkins and cattle melons *only*, but it is felt that this instruction was often overlooked. The usual method of planting these is amongst the maize. Only in comparatively few cases are pumpkins grown separately. The common cattle melon does not usually require planting; it volunteers freely, and, as it is well able to look after itself, it often yields abundantly year after year without special attention. Hence it was felt that in the returns sent in previously the acreage devoted to these crops should have been comparatively small instead of being shown in hundreds of acres. The area devoted to pumpkins and cattle melons was returned as 2,798 acres, as against 3,499 acres in 1920. It is open to doubt, however, whether these figures, in view of the above remarks, are reliable.

Ground Nuts.—The average yield per acre was 8.0 bags, which is higher than the 1920 yield, viz., 6.8. The acreage devoted to the crop was almost doubled.

Potatoes.—The increase in area planted to the summer and winter crops was over one hundred acres each. The acre yield, however,

receded from 26 bags in 1920 to 23 in 1921. There were individual yields of over 100 bags per acre.

Beans and Peas.—The first-named occupied 2,285 acres and the yield was 3.2 bags per acre, a slight improvement on the 1920 figures. Peas were grown chiefly as a green vegetable, and as such do not figure in the returns; 90 acres were planted for seed. The acre yield was 2 bags of 203 lbs.

Lucerne.—This valuable fodder can boast of only 205 acres, an increase of 89 acres on the 1920 figure.

Fodders.—Teff grass appears to be retrieving its reputation. It had 1,128 acres devoted to it, as against 968 in 1920.

Napier fodder has lost ground. Its area is returned at 825 acres, a decrease of 187 acres.

Molasses grass and Kikuyu figure for the first time in the returns with 85 and 91 acres respectively.

Sunflowers.—The acreage under this crop more than doubled itself, rising from 1,826 in 1920 to 3,974. The acre yield, however, was not so good as in 1920. As a poultry feed, sunflower seed is of first importance. The stalks are also of some value for silage purposes.

Fibres.—Sisal, Sunn hemp and hibiscus had ground given them as follow, viz., 15 acres, 10 acres and 5 acres respectively.

Other Crops.—The majority of the crops showing a small acreage were in the nature of experiments and do not call for special comment.

Citrus Orchards.—It will be seen that the total of orange trees bearing does not compare favourably with that for 1920. The reason for this is that returns were not received for a number of farms with orchards large and small.

CITRUS ORCHARDS.

	Trees bearing.	Not bearing.	Total.
Oranges	49,169	100,858	150,027
Lemons	9,446	5,483	14,929
Limes	531	152	683
Naartjes	4,098	1,549	5,647
Grape Fruit	5,804	853	6,657
Pampelmoes	200	55	255
	69,248	108,950	178,198

RETURN OF OCCUPIED FARMS IN SOUTHERN RHODESIA IN 1921.

Wankie, 42; Sebungwe, 4; Nyamandhlovu, 62; Bulalima-Mangwe, 149; Matobo, 59; Umzingwane, 34; Bulawayo, 75; Bubi, 103; Insiza, 126; Belingwe, 41; Gwanda, 36; Selukwe, 78; Gwelo, 302; Gutu, 49; Chibi, 3; Ndanga, 16; Victoria, 142; Chilimanzi, 87; Charter, 123; Marandellas, 140; Hartley, 298; Salisbury, 220; Lomagundi, 200; Mazoe, 291; Darwin, 20; Mtoko, 2; Mrewa, 26; Makoni, 149; Inyanga, 31; Umtali, 143; Melsetter, 139. Total, 3,190.

TABLE II.

Districts in order of Acreage of Cultivated Land.

District.	1920-21.		1919-20.		1918-19.		1917-18.	
	Acres.	Sequence.	Acres.	Sequence.	Acres.	Sequence.	Acres.	Sequence.
Mazoe ...	75,932	1	67,781	1	64,279	1	58,839	1
Salisbury ...	39,594	2	34,079	2	33,166	2	41,622	2
Lomagundi ...	21,864	3	17,938	3	15,533	4	18,096	4
Hartley ...	19,058	4	17,691	4	17,489	3	23,876	3
Gwelo ...	17,164	5	15,777	5	15,525	5	16,274	5
Marandellas ...	6,128	6	5,912	6	5,670	7	7,538	7
Victoria ...	5,718	7	5,095	8	4,154	9	5,225	11
Makoni ...	5,690	8	5,409	7	5,614	8	8,163	6
Insiza ...	4,693	9	5,018	9	5,904	6	5,785	8
Charter ...	4,598	10	3,571	12	4,094	10	4,552	13
Bubi ...	4,224	11	3,991	10	3,815	14	3,524	14
Bulawayo ...	3,830	12	2,948	15	3,438	13	3,469	15
Bulalima- Mangwe	3,207	13	3,579	11	3,281	15	5,627	9
Umtali ...	3,238	14	3,093	14	3,074	16	4,728	12
Chilimanzi ...	3,216	15	2,906	16	3,942	11	5,312	10
Nyamandhlovu...	3,205	16	3,225	13	3,500	12	3,115	16
Melsetter ...	2,320	17	2,307	17	2,006	18	2,410	18
Matobo ...	1,783	18	1,586	18	2,129	17	2,652	17
Mrewa ...	1,727	19	1,200	21	1,211	21	1,233	20
Selukwe ...	1,724	20	1,017	22	1,376	20	1,212	21
Gutu ...	1,504	21	1,525	19	1,180	22	1,151	22
Umzingwane ...	1,262	22	825	24	951	24	978	24
Wankie ...	1,152	23	837	23	1,081	23	1,376	19
Ndanga ...	1,136	24	1,363	20	1,559	19	1,056	23
Darwin ...	1,079	25	686	25	590	26	492	26
Gwanda ...	987	26	651	26	653	25	762	25
Inyanga ...	506	27	593	27	183	28	335	28
Belingwe ...	451	28	399	28	424	27	434	27
Sebungwe ...	164	29	...	...	...	...	...	...
Mtoko ...	20	30	61	29	98	29	92	29
Chibi ...	4	31	31	30	20	30	25	30
Bikita ...	...	32	...	...	...	...	...	...
	237,268	...	211,094	...	205,439	...	229,953	...

TABLE III.
Cultivated Crops in order of area in 1920-21.

Crop.	Acres.	Acre yield.				
		1921.	1920.	1919.	1918.	1917.
Maize ...	186,246	6.55 bags	6.45	5.13	3.08	4.62
Tobacco ...	9,531	393 lbs.	390	350	179	456
Wheat ...	7,118	3.9 bags	3.3	3.0	2.0	2.0
Maize (silage) ...	6,305	4.3 tons	3.17	2.3	2.2	2.0
Ground nuts ...	4,414	8 bags	6.8	6.2	2.8	6.3
Sunflower ...	3,974	5.8 bags	6.7	3.6	2.2	3.3
Beans ...	2,285	3.2 bags	2.04	1.4	1.0	1.9
Potatoes ...	2,077	23 bags	23.4	21.7	12.4	14.0
Velvet beans ...	1,899	...	...	...	...	...
Oats ...	1,616	...	...	...	...	...
Pumpkins ...	1,594	9 tons	5.4	1.9	2.5	2.1
Cattle melons ...	1,204	8.3 tons	5.7	2.6	1.0	3.6
Teff grass ...	1,128	...	...	...	...	...
Cow peas ...	988	...	...	...	...	...
Napier fodder ...	825	...	...	...	...	...
Cotton ...	802	...	...	...	...	...
Barley ...	769	...	...	...	...	...
Sweet potatoes ...	712	18.3 bags	9.2	...	...	...
Oat hay ...	689	...	...	...	...	...
Kaffir corn ...	653	2.3 bags	3.5	...	...	...
Millet (mannu) ...	462	...	...	...	...	...
Buckwheat ...	300	2.5 bags	2.8	1.7	1.7	2.6
Rupoko ...	243	2.6 bags	2.5	...	...	...
Lucerne ...	205	...	...	...	...	...
Barley (green fodder) ...	196	...	...	...	...	...
Onions ...	146	...	...	...	...	...
Rye ...	130	...	...	...	...	...
Rice ...	112	3.7 bags	...	...	...	...
Kikuyu grass ...	91	...	...	...	...	...
Peas ...	90	1.2 bags	...	...	...	...
Molasses grass ...	85	...	...	...	...	...
Paspalum ...	70	...	...	...	...	...
Sundry vegetables ...	54	...	...	...	...	...
Dhal ...	54	...	...	...	...	...
Linseed ...	52	2.5 bags	2.2	...	...	...
Sudan grass ...	51	...	...	...	...	...
Sisal ...	15	...	...	...	...	...
Mungoza ...	15	8.3 bags	...	...	...	...
Sunn hemp ...	10	...	...	...	...	...
Cassava ...	10	...	...	...	...	...
Mangels ...	9	...	...	...	...	...
Mfufu ...	6	...	...	...	...	...
Broom corn ...	5	...	...	...	...	...
Hibiscus fibre ...	5	...	...	...	...	...
Coffee ...	4	...	...	...	...	...
Niger oil ...	4	...	...	...	...	...
Emmer wheat ...	4	...	...	...	...	...
Tonga beans ...	2	...	...	...	...	...
Soya beans ...	2	...	...	...	...	...
Rape ...	2	...	...	...	...	...
Sweet sorghum ...	2	...	...	...	...	...
Chillies ...	2	...	...	...	...	...
Sugar cane ...	1	...	...	...	...	...
237,268						

TABLE IV.

Acreage in relation to Class of Crop, 1920-21.

Class.	Crop.	Acres.	Total acres.
GRAIN	Maize ..	186,246	
	Wheat ...	7,118	
	Oats ...	1,618	
	Barley ...	769	
	Kafir corn ...	653	
	Buckwheat ...	300	
	Rupoko ...	243	
	Rye ...	130	
	Rice ...	112	
	Mungoza ..	15	197,204
SUCCULENT AND ROOT CROPS	Maize (silage) ...	6,305	
	Potatoes ...	2,077	
	Pumpkins ...	1,594	
	Cattle melons ...	1,204	
	Sweet potatoes	712	
	Cassava ...	10	11,902
LEGUMES	Ground nuts ..	4,414	
	Beans ..	2,285	
	Velvet beans ..	1,899	
	Cow peas ..	988	
	Lucerne ..	205	
	Peas ...	90	
	Tonga beans ...	2	
	Soya beans ...	2	9,885
FODDERS	Teff grass ..	1,128	
	Napier fodder ...	825	
	Oat hay ...	689	
	Millet ...	462	
	Barley (green fodder)	196	
	Molasses grass ..	95	
	Kikuyu grass ...	91	3,486
VARIOUS	Tobacco ...	9,531	
	Sunflower ...	3,974	
	Cotton ...	802	
	Sundry ...	271	
	Onions ...	146	
	Linseed ...	52	
	Sisal ...	15	14,791
			237,268

Native District	Area under cultivation.	Maize.				Sisal.	Wheat.	Oats.	Barley.	Rye.	Kaffir Corn.	Sorgho.	Millet.	Sesuvium.	Brickellia.	Ground Nuts.		Beans.		Onions.							
		Grain.		Silage.												Acres under crop.	Yield, Tons of 500 lbs.	Acres under crop.	Yield, Tons of 500 lbs.	Acres under crop.	Yield, Tons of 500 lbs.	Acres under crop.	Yield, Tons of 500 lbs.	Acres under crop.	Yield, Tons of 500 lbs.	Acres under crop.	Yield, Tons of 500 lbs.
		Acres under crop.	Days of 20 lbs.	Reverse Days of 20 lbs.	Acres under crop.	Days of 20 lbs.	Days of 20 lbs.	Days of 20 lbs.	Days of 20 lbs.	Days of 20 lbs.	Days of 20 lbs.	Days of 20 lbs.	Days of 20 lbs.	Days of 20 lbs.	Days of 20 lbs.												
Wankie	1,152	933	3,674	2,815	5	40	4	12	...	2	56	255	...	...	16	123	...	3	26	1	4	4	198		
Nyamandlovu	3,205	2,245	11,273	4,553	350	1,892	34	30	...	1	90	193	...	...	44	167	...	63	292	4	11	3	30		
Botswana-Mangoch	3,297	2,499	7,199	4,982	296	721	41	37	25	7	1	16	46	...	44	184	...	20	26	17	22	2	...				
Marikop	1,783	1,259	6,704	3,791	176	769	21	12	...	...	9	66	...	...	11	58	...	96	774	12	36	1	3
Umtungwa	1,392	935	3,432	1,941	104	236	13	4	...	...	20	40	...	...	5	27	...	13	71	5	0	13	6
Hohawayo	3,850	2,391	10,204	4,718	601	2,641	60	...	...	2	1	2	...	...	27	265	...	20	274	12	20	14	6
Salisbury	164	130	2,000	300	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	17	3	2
Buli	4,224	3,305	15,570	7,368	475	3,060	54	4	...	...	6	42	...	...	31	126	...	33	235	20	63	...	...		
Inyanga	4,693	3,508	9,327	6,383	430	2,575	55	22	...	2	7	2	...	...	109	196	...	8	17	22	20	3	27		
Belingwe	451	292	1,202	730	63	208	8	20	...	...	10	...	...	...	1	5	...	3	19	3	5	...	...		
Gwanda	387	307	1,064	1,226	145	283	13	...	...	...	104	116	...	...	14	84	...	10	233	2	10	...	...		
Salisbury	1,724	1,434	4,644	2,161	33	138	7	22	6	11	10	...	...	...	2	2	...	1	2	24	18	11	17	
Gwelo	17,164	14,553	38,068	19,061	429	2,137	63	263	98	42	5	36	66	...	10	22	...	167	633	6	14	...	...		
Guta	1,504	822	1,898	1,118	12	26	4	440	17	19	12	6	16	...	24	90	...	14	12	...	...	...	...
Chibuto	4	3	5	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ndanga	1,136	1,074	4,430	300	...	...	...	45	...	...	...	...	...	...	...	...	...	...	...	1	9	4	8
Rhodesia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Victoria	5,719	4,718	10,688	5,083	165	890	21	255	20	7	3	12	23	...	41	130	...	3	35	...	...	...	...
Chilimanzi	3,216	1,133	2,831	2,209	96	342	5	1,395	100	48	11	...	43	126	...	34	93	...	14	97	...	...	...	
Charter	4,598	1,978	3,493	2,000	118	380	16	1,323	371	71	22	34	64	...	34	67	...	4	8	...	...	...	...
Mazandela	6,128	1,847	7,304	4,828	164	738	17	184	...	78	...	6	2	...	...	...	...	...	...	...	...	...	...
Harley	10,158	14,718	61,833	18,114	347	1,481	41	702	148	96	5	20	114	...	28	78	...	98	333	11	40	...	...		
Salisbury	20,564	30,680	190,190	81,066	1,132	8,217	100	427	336	134	1	79	30	...	16	81	...	915	4,845	31	130	...	...		
Longwani	21,894	18,030	78,412	24,622	316	1,540	46	56	...	2	...	4	33	...	1	11	...	136	764	14	22	...	...		
Mase	75,002	67,840	638,020	64,303	613	3,064	107	320	113	31	...	6	35	...	...	...	...	6	28	...	...	...	...
Darwin	1,079	351	7,490	2,800	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mtoko	20	20	140	140	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Murewa	1,727	730	2,474	701	85	505	2	6	...	5	...	...	...	...	...	...	...	...	...	...	...	...	...
Makoni	3,660	3,708	16,044	6,289	73	306	9	210	155	55	30	...	...	...	4	12	...	14	3	...	...	...	...
Isipingo	300	107	311	301	...	...	1	183	9	9	...	...	...	...	...	...	...	...	...	...	...	...	...
Umtali	3,228	2,220	12,124	6,313	141	915	9	227	100	27	3	20	100	...	36	104	...	7	22	...	...	...	...
Melsetter	2,220	383	4,706	4,303	6	48	1	697	127	27	16	...	...	...	12	41	...	...	...	...	...	...	...
Totals	237,398	186,240	1,220,768	590,850	6,305	37,060	732	7,118	1,616	700	130	653	1,826	2,044	685	112	424	3,674	23,204	300	733	4,414	35,706	2,285	5,238	1,454	...

Statistical Statement of Crops, 1920-21.

Page	No.	Area		Perimeter		Cattle		Horse		Sheep		Pigs		Goats		Total		Total		Total		Notes
		Area	Perimeter	Cattle	Horse	Sheep	Pigs	Goats	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total		
																					Area	
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
24	24	24	24																			

Common Mistakes in Growing and Handling Virginia Tobacco.

By H. W. TAYLOR, B.Agr., Tobacco Expert.

During the past few years almost any grade of Virginia tobacco found ready sale in South Africa, although the prices paid were not always remunerative. This was due to the fact that there was an abnormal demand for tobacco and to the shortage of leaf supplies. There has, however, been a considerable increase in production during the past three years.

PRODUCTION OF RHODESIAN VIRGINIA TOBACCO.

1917-18.	1918-19.	1919-20.	1920-21.
415,210 lbs.	1,179,932 lbs.	2,435,994 lbs.	3,192,662 lbs.

This increase in production, without a corresponding increase in consumption, and the recently imposed excise duty, have decreased the demand for inferior tobacco. Indeed, some of the very low grades are now practically unsaleable.

It is feared that the ready sale for low grade leaf which existed during the past few years has encouraged growers to produce tobacco on an extensive rather than intensive scale, with detriment to the industry and themselves. Now that very inferior leaf is practically unsaleable, it is urged that every grower should practise such cultural and handling methods as will result in an increased percentage of leaf of good quality. In fact this is imperative in order that the tobacco industry may continue to expand. At present the amount of Rhodesian Virginia tobacco produced is adequate for South African requirements, and any additional production must be exported in some form. It is well understood that, on account of transportation and other charges, the exportation of inferior tobacco would be unprofitable even if a market could be found for this class of leaf.

The following notes have been prepared from observations made by the writer during the past three seasons. Any statements regarding climatic conditions are based on accurate records compiled by the Meteorological Division for a period of years. These notes are submitted in order to assist tobacco growers, and are not in the nature of a criticism.

Seed Beds.—Each year a number of growers are severely handicapped through not having sufficient plants or by being forced to use transplants which are unsuitable. Lack of suitable transplants may

be due to the ravages of insects; in which case growers would do well to study carefully the information contained in Bulletin No. 347, issued by the Department of Agriculture, which deals exhaustively with the subject of insects attacking tobacco. In most cases, however, shortage of transplants is due to faulty preparation of the seed beds, to careless management or the selection of an unsuitable site.

The soil for tobacco seed beds should be thoroughly sterilised before final preparation and seeding. The easiest and most economical method of sterilising the soil is by burning with an open fire. When this method of sterilising is adopted the surface of the soil is covered with a thick layer of ashes. Unless the ashes are thoroughly mixed with the surface soil germination will be poor and the stand of plants will be thin and patchy. On the other hand, if the ashes are thoroughly mixed with the surface soil to a depth of about three inches germination of the seed will not be adversely affected, and the growth of the seedlings will be rapid and uniform.

Some growers begin seeding their beds late in August or the first part of September. If the beds are properly handled, seedlings should be ready for transplanting within sixty days from the date of sowing the seed. The seedlings in beds prepared late in August or early in September should be ready for transplanting late in October or the first week in November. Rainfall records over a long period show that there is seldom an opportunity of transplanting tobacco before the middle of November. The seedlings in the very early beds are therefore usually discarded when they become too large for transplanting, or they are kept stunted through lack of moisture, and develop tough stringy stems, which render tobacco seedlings unsuitable for transplanting. In the former case there has been a needless waste of time and expense, while in the latter unsuitable transplants are used which generally make unsatisfactory growth in the field. The first seed beds should generally not be seeded until the middle of September, and should be seeded at intervals up to the middle of November, but not later. If beds are sown later than this there will be suitable transplants well into January, and these will often be used, although the growers know that the proper time for transplanting tobacco has already passed.

Water is the first requisite for producing tobacco seedlings, and for this reason the seed beds must be located near a permanent supply of water. On many Rhodesian farms the only permanent water supply is found in low lying wet vleis. In most cases the vlei soil is too wet, and on account of the location the atmosphere is very cold at night during the early part of the season. If the soil is too wet this defect can usually be remedied by providing open drains four feet wide and three feet deep around the area selected, with an additional channel cut from the lowest point to lead away all drainage water. Seed beds located in vleis are usually exposed to cold winds at night and hot dry winds during the day. This condition can be remedied by erecting an artificial shelter of grass around the seed beds. Such shelters are inexpensive, and have the double effect of preventing the surface soil from rapidly drying during the day and keeping the beds warm at night. Rapid drying of the surface soil during the day and chilling

during night both adversely affect the germination of tobacco seed and the growth of young seedlings. Drainage and shelter are often overlooked by growers when preparing tobacco seed beds, and this neglect is the cause of many seed bed failures in Southern Rhodesia.

The interval between sowings of seed beds is very important. Some growers follow the erroneous practice of sowing one bed each day or every second day from the time their beds are started until seeding is finished. In practice the obvious result is that only a very few beds contain plants which are of the proper size for transplanting at one time and transplanting is delayed. These growers therefore usually transplant seedlings which are too large, the correct size and those which are too small in the same field on the same day. This naturally results in uneven growth in the field, which complicates harvesting and curing. The best practice is to sow, at intervals of about fourteen days, sufficient seed beds to transplant one-fourth of the intended crop, allowing 20 square yards of seed bed per acre.

In order to economise, some growers use grass instead of cheese cloth for covering their seed beds. Grass coverings do not protect the seedlings from the ravages of insect pests, and, in order to have sufficient plants, larger areas of seed beds are necessary. The preparation and care of additional beds, together with the cost of cutting grass and combating insects, make grass coverings almost, if not equally, as expensive as cheese cloth covering. In addition, grass coverings are difficult to handle. Most growers make their grass coverings too thick, with the result that the plants suffer from want of sunlight, which renders them weak and tender. Watering is usually done without removing the grass, and when this practice is followed the water is applied unevenly, which gives unsatisfactory results.

Transplanting.—When the seedlings are from four to six inches in height they are ready for transplanting. In order to hasten transplanting some growers use smaller plants. If the weather conditions are favourable small transplants will grow, but a few hours of hot sun immediately after transplanting will kill or severely retard the growth of small transplants. On the other hand, overgrown, tough and woody plants are often used to obtain the intended acreage. Such plants rarely make satisfactory growth. As a rule the flower head appears whilst the plants are small, and after topping the leaves remain small and do not ripen normally. The tobacco harvested from such plants is usually very small and inferior, and the additional acreage obtained through using unsuitable transplants is almost always grown at a loss.

In order to obtain the intended acreage growers often transplant after the first week in January. Experience is the best guide as to the proper time for planting farm crops in any country. It has been ascertained from actual results that, in Rhodesia, the best yields and best quality tobacco are obtained when the crop is transplanted during the latter part of November and December. Tobacco transplanted after the first week in January rarely produces leaf of satisfactory quality. Tobacco transplanted at the proper time grows rapidly and matures while the weather is warm and before the rains have ceased, so that

the leaf yellows well on the land and is easily cured. If transplanted after the first week in January, tobacco usually reaches maturity when the nights are cool, the soil and atmosphere are dry, and does not yellow in the field. The leaf, although small, is usually heavy, coarse and leathery, and hence difficult to cure. In this connection it should be stated that in every part of the world where bright tobacco is produced, late planting is considered undesirable. Hart* states:—"To get best results with bright tobacco, it is essential that the crop be planted as soon as the weather warms up sufficiently in the spring and the plants are ready for transplanting. It is desirable to have tobacco off the hill (harvested) before the cold nights, as it is impossible to get as good colour then as with tobacco cured during the warm weather of August and early September." Mathewson† states that "Tobacco which reaches maturity and is harvested while the weather is yet warm generally will be decidedly better in quality, particularly in respect to colour, than later cuttings. Growers should make a strenuous effort to have an early crop by planting early and by choosing land on which the plants will grow quickly." In Nyasaland also late planted tobacco generally produces low grade leaf. If the major portion of the intended acreage has been transplanted by the first week in January the remainder should be planted to other crops, and additional care given to the acreage transplanted in order to increase the yield and improve the quality. Tobacco growers in Southern Rhodesia are therefore strongly advised to discontinue transplanting after the first week in January. If it is found to be absolutely necessary to plant out later than this time, that portion of the crop should be given an additional application of water soluble fertiliser in order to hasten the maturity of the plants.

One of the primary causes for low yields in Rhodesia is the imperfect stand of plants in tobacco fields. This may be caused by weather conditions, insect pests or bad transplanting. In any case the blanks in every row should be filled in as soon as possible after the first transplanting in order to secure a practically perfect stand. The proper distance for transplanting tobacco is at intervals of three feet in rows with the rows three feet apart. If the plants grow to medium size six plants should be the maximum required to produce one pound of cured tobacco, which at the above distance of planting would give a yield of 800 lbs. per acre. The average yield last season was only 404 lbs. per acre, which indicates that either the stand was very poor, or that the plants made poor growth, or both. In order that tobacco may be grown at a profit the stand of plants should not be less than 75 per cent.

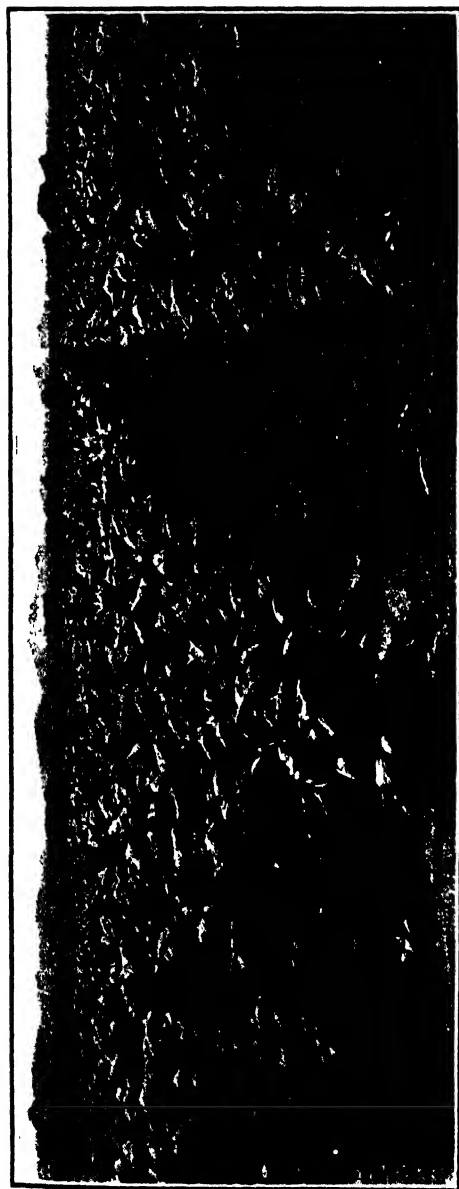
Acreage.—Most tobacco growers transplant more tobacco than can be properly handled with their complement of labour and curing facilities. Many of them frankly admit that their acreage is greater than can be properly handled, but excuse the practice by saying that they will only harvest the best leaf. There can be little doubt that

*J. C. Hart. Production of Bright Tobacco. Bulletin No. 62, Virginia Agricultural and Mechanical College.

†E. H. Mathewson. The Culture of Flue-Cured Tobacco. Bulletin No. 16, U.S. Department of Agriculture.



No 1 Plants on right fertilised before transplanting; those on left after transplanting. All tobacco transplanted the same day. Great B Farm, property of Mr. A. C. Henderson



No 2 Tobacco topped at correct height for proper leaf development

this is their original intention, but when the marketable leaf has been harvested and cured they continue with inferior tobacco until frost forces them to cease their misdirected efforts. Transplanting a larger acreage than can be handled is wrong both in theory and practice. It results in the production of a high percentage of very inferior tobacco, which reduces the average price for the leaf of good quality and gives the grower a false impression as to the real value of marketable tobacco. The cost of preparing, fertilising, transplanting, cultivating, harvesting and curing the additional acreage is very considerable and usually results in producing the whole crop at a loss. If the additional labour and fertiliser were used in growing, harvesting and handling the proper acreage, the yields would be higher, the quality of the cured leaf would be greatly improved and the crop would be grown at a profit instead of at a loss.

As labour is generally available, curing and handling facilities are the limiting factors. In regard to curing facilities it can be safely stated that where the stand is good and the plants make satisfactory growth one barn (16 ft. by 16 ft. by 20 ft.) will not properly accommodate more than 10 to 12 acres unless the grower is very fortunate in being able to transplant his crop with intervals of about four weeks between plantings. For 50 acres of properly grown tobacco, four barns are necessary in order to handle the leaf at the proper time and without crowding the tobacco into the barns. With tobacco of normal size, a curing barn 16 ft. square and 20 ft. high will hold, when properly filled, approximately 800 sticks of tobacco. In order to get their whole crop cured, some growers place 1,200 sticks of tobacco in barns of this size and the results are unsatisfactory. Growers are therefore strongly urged to curtail their acreage to meet their available curing accommodation, or else to provide sufficient barns to properly handle any increase in acreage.

Fertilising.—In Southern Rhodesia practically all Virginia tobacco is grown on light, sandy soils. These soils are naturally unfertile, but respond readily to applications of fertilisers or manure. To obtain satisfactory yields of good quality leaf a complete fertiliser—that is, one containing nitrogen, phosphoric oxide and potash—is required.

Tobacco growers generally do not apply fertilisers in sufficient amounts to obtain the best results. Light applications give the plants a good start, but do not carry sufficient plant food to develop the maximum yield per acre, so that no economy is effected. Light applications of fertiliser produce small leaf of poor body, which, although bright in colour, is usually unprofitable on account of the low yield per acre. Tobacco of better quality and larger yields per acre would be obtained if heavier applications were made and the acreage reduced accordingly.

The time and manner of applying fertiliser are also of considerable importance. The usual practice is to apply fertiliser around the plants after growth begins. Some growers transplant their whole crop before commencing to fertilise, with the result that practically the whole crop comes into maturity at the same time. This would be no disadvantage if sufficient labour and barn accommodation were available to handle the whole crop in a short time, but this is seldom the case.

When barn accommodation is limited and labour is dear and difficult to obtain at short notice it is best to fertilise the first half of the crop before transplanting. Fertilising before transplanting will hasten maturity (see Plate I.) by at least two weeks, and so give a longer period for harvesting and curing. In fertilising before transplanting, holes are made in the ridges with hoes, the requisite amount of fertiliser is placed therein and the hole partially filled with soil. The plants are placed directly over the fertiliser so that they receive a liberal amount of plant food as soon as they begin to grow.

Topping.—It may be stated that as a general rule Rhodesian growers top their tobacco too high. The conclusive proof is the amount of leaf too short to tie into "hands" which is received at the tobacco warehouse. The percentage is as follows:—

1917-18 crop, 34.12 per cent.

1918-19 crop, 14.38 per cent.

1919-20 crop, 15.68 per cent.

In topping tobacco the terminal bud is removed with the object of leaving on each plant the number of leaves which can be properly developed in order to increase the yield per acre and to improve the quality of the cured product. If the plants are topped too high the leaves will be small, lacking in quality and will realise a low price when cured and marketed. The cost of harvesting, curing and handling is greater, as more leaves must be handled, and since the selling price is lower the profits are decreased. Tobacco which is properly topped produces leaf of good size and quality, and, although the percentage of bright leaf may be slightly lower, the average selling price will be higher and the profit per acre greater, as the cost of production is lower.

Many growers wait until the plants are in full flower before starting to top their tobacco. This is a mistake, as an enormous amount of plant food is wasted in the development of the flower head and discarded leaves. Also the stalk becomes hard as the flower head develops, and the operation of topping is rendered more difficult. *The proper time to top tobacco is when the requisite number of leaves have developed and while the stem of the plant is soft and succulent.* (See Plate II.)

No rule can be laid down as to the proper height to top tobacco. On fertile soils or where the soil has been heavily fertilised more leaves can be left per plant than on lightly fertilised or poor soils. Also vigorous-growing plants will develop a larger number of leaves than weak-growing plants. Unless the soil is above the average in natural fertility and is heavily fertilised, on sandy soils not more than twelve leaves, and in many cases less, should be left on the plants, not counting sand leaves, which should be primed off and discarded. On the heaviest Rhodesian soils which have been heavily fertilised the maximum should be sixteen leaves per plant. Greater care and attention in connection with the important operation of topping would undoubtedly increase the yield per acre and improve the average quality of Rhodesian Virginia tobacco.

About ten days after topping, suckers will appear in the axils of the leaves, and these must be removed or the whole object of topping

will be defeated. If suckers are allowed to grow, the yield per acre will be reduced and the quality of the cured leaf will be seriously affected. Some growers maintain that suckers should be allowed to grow in order to produce bright leaf, but this is usually an excuse for bad handling of the crop—when the acreage planted is in excess of the labour available. However, when a period of wet weather occurs just as the tobacco is ripening, it may be to advantage to allow suckers to grow temporarily, as their growth will tend to absorb plant food and prevent second growth of the plants, which causes the leaf to become coarse and dark.

Harvesting.—This operation is of the greatest importance in connection with the production of bright tobacco. Although the crop may be promising and well grown, unless the leaf is harvested at the correct stage of ripeness the cured product will be disappointing. Should the leaf be harvested before it is properly ripe, the cured tobacco will retain much of the original green colour, which is very objectionable to manufacturers and *greatly reduces the value*. On the other hand, if the leaf remains on the plant for some time after becoming ripe the cured product will be brittle, lifeless and will be classed as perished, which somewhat reduces the value. It is, however, better to allow tobacco to become over-ripe rather than run the risk of harvesting the leaf too green.

The indications of ripeness vary according to the texture of the tobacco. Tobacco which will cure out bright should take on a decided light greenish yellow colour when ready for harvesting. If the leaf is of heavy texture it should be medium bright or dark when cured. Such leaf will not show the decided greenish yellow colour in the field, and ripeness is usually indicated by the brittleness of the leaf, which shows yellow flecks or spots of yellow on the upper surface.

In order to obtain satisfactory results in curing, tobacco of light, medium and heavy texture should not be mixed together in the curing barn. Each of these classes of leaf requires a different period of time to yellow, fix the colour and to cure out, so that if one class is properly treated the remainder is ruined. Many growers in Rhodesia make this mistake, which is often due to the fact that natives harvest the tobacco without adequate white supervision. Again, if unripe, ripe and over-ripe tobacco is mixed together in the curing barn, the results are disappointing for the above-mentioned reasons.

Most Rhodesian growers have a good working knowledge of the practice of flue curing tobacco, and, from field observations, it is the writer's opinion that the unsatisfactory colour of much of the cured product is due largely to harvesting tobacco somewhat before the leaf is ripe and to mixing tobacco of different textures and widely different stages of ripeness in the curing barns.

Curing.—As stated above, most Rhodesian growers have a good practical knowledge of flue curing tobacco. The principal mistake made in this operation is in curing out the leaf before the original green colour has disappeared. Growers maintain that this is at times necessary in order to prevent sponging. During the past two seasons growers have found that the damage due to "angular leaf-spot" is

reduced by harvesting tobacco before it is fully ripe and by hastening the curing. It should be pointed out that sponged and "spotted" leaf is of greater value than green leaf, and that the above practices result in decreased prices. Growers are therefore urged to allow the tobacco to yellow properly in the curing barn before fixing the colour and drying out the leaf.

For full instructions regarding curing tobacco, growers are advised to again read an article on this subject in the *Rhodesia Agricultural Journal*, December, 1919, or to apply to this Department for Bulletin No. 339.

It might be well to point out that many growers attempt to save that portion of the crop which has been in excess of their barn accommodation by sun curing. If the leaf is large, heavy and leathery, sun curing can be carried out to advantage, but if the tobacco is light in texture and suitable for fine, bright leaf the results of sun curing are always disappointing.

Management after Curing.—After the crop is grown and cured, many growers suffer considerable financial loss through improper handling of the cured leaf. The general practice is to bale the leaf direct from the barns without regard to size, colour or quality. The bales are then stored until the tobacco is sent to the central warehouse for preparation for market. If the leaf is mixed in colour and quantity loss must of necessity occur. If the tobacco contains the proper amount of moisture for bright leaf, the green leaf in the bales will not improve in colour. On the other hand, if the percentage of moisture is sufficient to bring about a change in colour of the green leaf, the bright tobacco will depreciate in value through becoming red or dark in colour.

The proper method of handling tobacco is to bring the leaf into condition after curing and place it in bulks instead of bales. As the barn is emptied the tobacco should be roughly sorted into leaf which is clear in colour—whether bright, medium or dark—and that which contains any definite shade of green. The leaf of clear colour should be bulked with just sufficient moisture to prevent breakage, while the green leaf should contain enough moisture to make the tobacco soft and supple. Bulks are best made about six feet wide and six feet high, but the length can be altered to meet the individual conditions. It is not necessary to complete a bulk in one day, as tobacco can be added from time to time. It is best to keep heavy weights on the bulks in order to compact the leaf to prevent the tobacco from drying out, and also to save space.

When curing is finished the grower can then grade the tobacco directly from the bulks. If facilities are available and labour obtainable, it is advised that the tobacco should be prepared for market on the farm. If circumstances do not permit of this, then the leaf should be roughly graded before being despatched to the warehouse for final treatment. Last season several growers were induced to bulk their tobacco direct from the barns instead of baling. In every case the grower has been more than satisfied with the results, and more than repaid for the time and additional expense. It is hoped that this practice will in time become general throughout all tobacco growing areas.

Annual Report of Experiments, 1920-21, Experiment Station, Salisbury.

(Concluded.)

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist.

SWEET POTATO VARIETY TRIALS.

Comparatively little experimental work has been carried out in Rhodesia with this most valuable crop, and one of the first steps to be taken is obviously that of separating the several different varieties which are being grown, often promiscuously. It is evident from the exhibits at our agricultural shows that the broad division into table and cattle classes does not adequately cover the varieties at present grown, and the first step in the improvement of this crop must be the separation and definition of the varieties. Following upon preliminary trials carried out in 1918 and 1919 six varieties were grown last season with a view to (a) determining the weight of tubers and green tops obtainable, and (b) identifying the separate varieties. The most obvious line of division in this crop is that based on leaf characters. About one-half of the varieties under trial are ivy-leaved, and the other half calabash-leaved. Generally speaking the ivy-leaved varieties gave a smaller weight of green tops, but a greater weight of tubers than the calabash-leaved varieties. It also appears that the ivy-leaved varieties give a greater weight of tubers than of tops. The contrary is the case with the calabash-leaved kinds.

	Date of planting.	Weight of green tops per acre.	Weight of tubers per acre.
1. Calabash leaf	23.12.20	20,700 lbs.	14,443 lbs.
2. Ivy leaf	23.12.20	11,600 lbs.	25,036 lbs.
3. Calabash leaf	12.1.21	10,600 lbs.	8,416 lbs.
4. Ivy leaf	12.1.21	3,260 lbs.	13,272 lbs.
5. Calabash leaf	10.2.21	7,528 lbs.	Failed to mature
6. Ivy leaf	10.2.21	7,660 lbs.	Failed to mature

Observations made with a view to describing the better known varieties showed the occurrence of considerable numbers of distinct types differing from each other in the following respects:—Shape of leaf, habit of growth, colour and size of tuber and date of maturity. Distinctive names cannot as yet be given even in cases where definite

distinctions occur, but the adjoining classification, which does not claim to be exhaustive or complete, may prove helpful. It will in any case serve a useful purpose in enabling the varieties usually grown in Rhodesia to be identified.

(a) *With entire leaves (calabash leaf type)*—

- (1) Tubers red and large, with white flesh; early maturity = Early Red.
- (2) Tubers white or yellowish, with white flesh; late in maturity; leaves with purple veins on lower side = Calabash.

(b) *With leaves 3-lobed (ivy leaf)*—

- (3) Stem hairy; runners lying flat on ground; tubers large with yellowish or whitish skin and yellow flesh = Early Butter.
- (4) Stem entirely free of hairs; runners upright when young, later becoming procumbent; tubers with pinkish or yellowish skin and yellow flesh = Common.

(c) *Leaves deeply cut into numerous lobes or fingers*—

- (5) Tubers red with white flesh; medium sized and medium early in maturity; leaves with five lobes usually, whitish on the under-side = Red Nancemond.
- (6) Tubers white with white flesh; small and long; leaves with five or seven lobes, and with purple veins on lower side = Common White.

BUCKWHEAT.

Although very quick maturing and often recommended as a catch crop, the date of sowing of buckwheat has a very marked effect on the yield. A date of sowing test was carried out in 1918, and the figures for both years are given here for comparison:—

Date of sowing.	Yield in 1921.	Yield in 1918.
21st December	620 lbs. per acre	
4th January		1,008 lbs. per acre
20th January	340 lbs. per acre	584 lbs. per acre
4th February		604 lbs. per acre.
14th February	448 lbs. per acre	
20th February		580 lbs. per acre
4th March		200 lbs. per acre

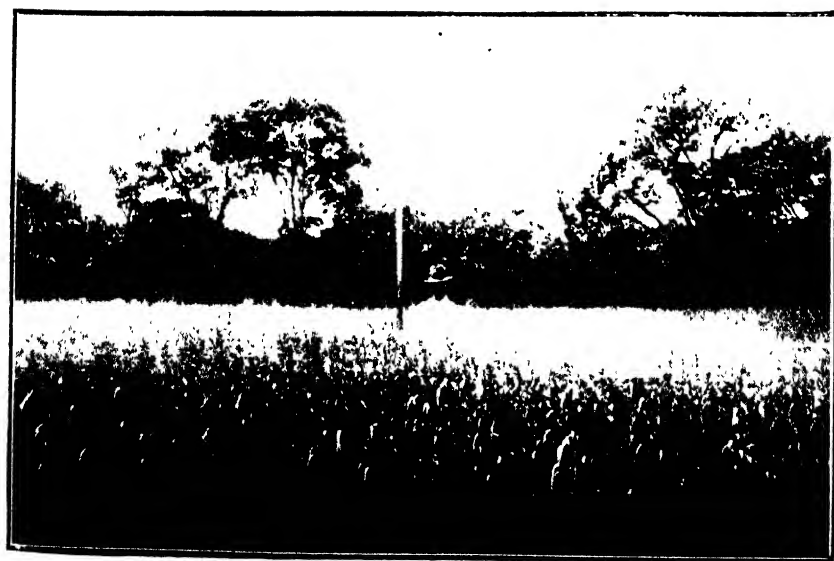
The yield of late sown crops is naturally largely governed by the incidence of the rainfall, but in a normal season the best results with buckwheat may be expected from sowings made about the end of December or early in January.

SUMMER OATS AND WHEAT FOR GRAIN PRODUCTION.

The growing in summer of quick maturing varieties of oats is well worthy of greater attention in view of the consistent good yields



Burt Oats Experiment Station, Salisbury



Kherson Oats undersown with peas Experiment Station, Salisbury

obtained with certain varieties which may be termed *rust-evaders*. Kherson or sixty-day oat is now well known by name, and it is satisfactory to record that its rust-resisting or rust-evading powers continue undiminished even when the seed has been grown in Rhodesia for a number of years. This oat still remains the basis for all summer tests with other varieties of the same crop. Four separate plots were grown on the station during this season. The stands in every case were excellent, and although rust appeared eventually, sufficient growth had been made to ensure a good return of fodder or grain. Cut for hay one plot yielded at the rate of 3,705 lbs. oat forage per acre. This, when subsequently threshed, produced 1,095 lbs. seed per acre. The yields of seed in the other cases were respectively 1,000 lbs., 939 lbs. and 654 lbs. per acre.

Burt oat proved an earlier variety and extremely vigorous, but lacked the rust-resistant properties of Kherson. Minnesota oats rusted badly. Neither of these newer introductions has equalled the Kherson oat for the purposes named above.

Equally good returns cannot be recorded for summer wheat, of which thus far the only variety at all promising is Yellow Cross. In spite of the usual good stand of straw, rust showed its effect in a small and shrivelled grain, and the best yield of 480 lbs. seed per acre is not sufficient to warrant the recommending of this variety for summer cropping. It remains to be seen, however, whether Yellow Cross has not a value as a summer hay crop, either in a mixture or as a pure sowing.

Emmer sown 6th February gave a good crop of green fodder and yielded at the rate of 1,000 lbs. seed per acre, but as against this the same crop in the previous season was a practical failure. The May rains were probably the influencing factor.

GROUND NUTS.

Experiments were conducted with the two varieties which have proved best suited to local conditions, namely, Spanish bunch and Virginia bunch, to test whether closer planting than is usually practised in Rhodesia might not result in better yields. The weights obtained were as follows:—

Variety.	Date planted.	Distance planted.	Yield unshelled nuts per acre.
Spanish	15.12.20	24 x 6 in.	1,280 lbs.
Virginia	15.12.20	24 x 6 in.	1,160 lbs.
Spanish	16.12.20	18 x 6 in.	1,668 lbs.
Virginia	16.12.20	18 x 6 in.	1,516 lbs.

It will be noticed that the yields vary almost exactly as the number of plants per acre, i.e., the yield per plant is constant in both plantings. Hence it is reasonable to suppose that a wider spacing than 18 inches by 6 inches is not necessary for this crop on our red soils. Further trials to confirm this have been arranged for the coming season. It is hardly necessary to point out that 18 inches between the rows is

too close to permit of other than hand cultivation. The crop is sown on the flat and twice ridged up during the growing period, either by hand hoe, wing shovel plough or cultivator.

VELVET BEANS.

The increasing appreciation of the value of this crop may be gauged from the fact that the area planted to it in 1920 was almost double that of the previous season, while in 1921 a further increase has been recorded. This is undoubtedly as it should be, for in the velvet bean we have a crop which will grow on all soils, that is particularly free from pests of all kinds, gives a good yield of palatable leguminous hay, seeds freely under the conditions obtaining in Rhodesia, and has a most beneficial effect on the soil. Its value as a green manure crop has been referred to elsewhere in this report. In short, the velvet bean fulfils in Rhodesia the role played by clover and by the cowpea in the countries where these legumes flourish. Several varieties of velvet beans exist, and have passed under trial at the experiment station, but only two are grown extensively. The older Florida bean which once enjoyed a monopoly in Rhodesia is now being largely replaced by the White-seeded Stingless variety, which has the advantage implied in its name of being free of stinging hairs. Comparative tests made with these two varieties seem to indicate the following differences:—

Florida Velvet Bean makes earlier growth, and is quicker in maturing, being ready to cut for hay in four months from the time of sowing. Does not give as heavy a yield of hay as the Stingless, but perhaps thrives better on poorer soil.

White-seeded Stingless.—A later and more prolific variety. Ready for cutting as hay in $4\frac{1}{2}$ to 5 months from the date of sowing. Does best on good soil. Seeds freely and is easier to handle on account of the absence of stinging hairs, but is possibly less hardy to disease, such as wilt or leaf scorch. This season gave a yield of pods and seed weighing 1,600 lbs. per acre, which when shelled yielded 880 lbs. of clean seed. The average yield of seed over the whole station amounted to 1,120 lbs. per acre.

Of the other varieties that have been tried one only deserves mention, viz., the Black-seeded. This does not, however, present any points of advantage over the other two varieties, and as the yield of hay and seed is distinctly lower is not likely to advance in popular favour.

HAY CROPS.

The question of the provision of dry fodder for stock feed should always be one of great interest to the farmer. It may be mentioned here that much less is seen nowadays of the poor late-cut veld hay than was at one time common, while cultivated hay crops, such as teff grass, manna and Sudan grass, are becoming increasingly popular, and often command a ready sale when available. Ordinary veld hay, even at its best, is far from being of high feeding value, owing to the many admixtures of poor quality which it contains. With cultivated hay crops

the value of the constituents is known to be high, their digestibility to be great, and in the case of leguminous crops their high protein content gives them an added value in providing a balanced feeding ration. The cultivated hay crop again can be sown at such a date as to ensure its being ready for the mower when weather conditions for cutting and curing are favourable, and whereas the yield of veld hay will vary greatly according to locality and season and is at no time very considerable, the returns from cultivated crops show a greater constancy. Teff and Boer manna have both given yields of over two tons of hay per acre, while several of the leguminous hays have exceeded this. On the whole mixtures have proved superior in yield to pure stands, and the reason for this would appear to be that in most seasons certain of the constituents of a mixture thrive exceptionally well, the others taking a secondary place, but helping to make weight, while in other seasons a different constituent may take the leading place. In this way poor yields from the mixtures are not common. A mixture of Sudan grass, teff and oats this season gave $1\frac{1}{2}$ tons of hay per acre as against an average of just over a ton for the pure stands. The leguminous hay crops, however, ranged from 3,132 lbs. per acre in the case of velvet beans to 4,860 lbs. per acre for Kudzu vine and 5,200 lbs. per acre for White dolichos beans. Oats as a summer hay crop deserve greater attention. They should be cut before rust can materially damage the leaf and stem. Kherson oat gave a yield of 3,705 lbs. of hay per acre. Burt oat also did well, and is recommended for the same purpose in localities of light rainfall. Yields of hay crops in detail were:—

Crop.	Sown.	Amount of Seed sown.	Date cut for Hay.	Green weight per acre.	Weight of Hay per acre.
		lbs.		lbs.	lbs.
Manna ...	21/12/20	15	2/4/21	.	4,344
Sudan Grass ...	6/1/21	20	4/4/21	..	1,908
Sudan Grass ...	11/1/21	...	2/4/21		3,030
Teff Grass ...	6/1/21	6	3/4/21		1,083
Oats, Sudan and Teff Grass	6/1/21	25	2/4/21	..	3,750
Oats, Sudan, Teff and Peas	6/1/21	20	2/4/21	..	2,736
Florida Velvet Bean ...	10/12/20	25	7/4/21	.	2,860
White Stingless Velvet Bean	10/12/20	25	7/4/21		3,132
Woodford's Dolichos Bean	11/12/20	25	30/4/21	14,300	...
White Dolichos Bean ...	11/12/20	25	3/5/21	18,700	5,200
Kudzu Vine ...	March, '18	...	12/4/21	12,096	4,860
Kudzu Vine ...	...	...	27/4/21	6,510	...

GREEN MANURING CROPS.

An article dealing with certain crops utilised for green manuring appeared in the October issue of the *Journal*, and the yields of maize after some of these crops have already been referred to. Niger oil continues to hold first place in weight of green growth produced, and it is interesting to record that this crop was successfully converted into a silage which proved palatable to cattle. The yields of various green manure crops were as follows:—

Crop.	Yield of green fodder per acre	Yield of green fodder per acre
	1920-21.	1919-20.
Niger oil	38,200 lbs.	29,040 lbs.
Sunn hemp	14,500 lbs.	19,344 lbs.
Black velvet bean	—	13,416 lbs.
Kaffir bean	—	13,680 lbs.
Ground nuts (Virginia) ...	—	7,920 lbs.
Woodford's dolichos bean	14,300 lbs.	—
White dolichos bean	18,700 lbs.	—
Kudzu vine	12,096 lbs.	—
Kudzu vine (later cutting)	6,510 lbs.	(much leaf dropped)

CROPS GROWN FOR SILAGE.

All the crops mentioned above can with one exception—Sunn hemp—be utilised for ensilage purposes, preferably in conjunction with maize, and either grown with this crop or separately. In the case of certain of them their climbing habit makes it profitable to grow them among the maize plants. The crop most used for this purpose is the velvet bean, and the results of the comparative trials shown below go to prove that there is no better crop for this purpose.

	Yield of green fodder per acre.
Maize and velvet beans (sown together)	26,700 lbs. per acre
Maize and dolichos beans (sown together)	23,632 lbs. per acre
Maize alone	22,020 lbs. per acre
Maize and kaffir beans (sown together)	19,320 lbs. per acre
Maize and Black-eyed Susan pea (sown together)	12,752 lbs. per acre

Note.—The peas dried off before the maize was ready for the silo, and on this plot maize made very poor growth.

INDIGENOUS GRASSES.

Reference has been made in previous reports to the success obtained with pure stands of the best of our native grasses, and to the great promise shown by certain of their number as pasture and hay grasses. The trials were continued and extended during the past season. The yield of green fodder from certain of the plots was investigated, while at the same time arrangements were made to determine by analysis their comparative feeding values. These latter are not yet available,

but the weights obtained are instructive as showing the great divergence between various constituents of the natural veld and the excellence of the best of our native grasses. The plots were cut on the 23rd March, and the weights therefore practically represent a full season's growth. The plots in each case are of approximately the same density, so that the difference can safely be ascribed to the variety.

Name of grass.	Green weight.
1. Tussock grass (<i>Setaria lindenberghiana</i>)	34,270 lbs. per acre
2. Fine-leaved Guinea grass (<i>Panicum marimum</i>), cut 23.3.21	16,675 lbs. per acre
3. Fine-leaved Guinea grass (<i>Panicum marimum</i>), cut 23.5.21	30,060 lbs. per acre
4. Penhalonga grass (undetermined)	29,930 lbs. per acre
5. Rhodesian paspalum (<i>Brachiaria brizantha</i>) .	19,950 lbs. per acre
6. Rhodesian Buffel grass (<i>Panicum marimum</i> ?)	17,365 lbs. per acre
7. Antelope grass (<i>Echinochloa pyramidalis</i>)	16,100 lbs. per acre
8. Rhodesian timothy (<i>Setaria aurea</i>)	11,540 lbs. per acre
9. Catstail grass (<i>Sporobolus pyramidalis</i>) .. .	3,450 lbs. per acre

Tests made some years ago with Napier fodder planted 6 feet apart each way showed a yield of 25,000 lbs. of green fodder per acre. It must be made clear, however, that grasses Nos. 1, 2 and 3 are either too coarse or too dense in their growth to be cut with a mow for hay, and in these cases the weights represent the amount of green fodder (less waste) which they would afford for grazing.

MISCELLANEOUS CROPS.

The following seed yields of crops grown during the year under review and not referred to elsewhere in this report are recorded —

	Average yield.
Hibiscus cannabinis	584 lbs. seed per acre .
Sunn hemp	986 lbs. seed per acre
Black-eyed Susan pea	410 lbs. seed per acre
Linseed	396 lbs. seed per acre
Sunflower	1,752 lbs. seed per acre
Niger oil	560 lbs. seed per acre
Yellow lupins	450 lbs. seed per acre
Red manna	450 lbs. seed per acre

Small plots of a number of imported varieties of potatoes were also grown, but owing to late arrival of seed results were inconclusive, and the tests will therefore be continued and be reported upon next season. Native and imported varieties of dry-land rice were grown as rainy season crops, but, as in previous years, the red soil was found to dry out too rapidly for this crop, and the plants withered off without setting seed, just as they came into ear. A number of varieties of kaffir corn were also grown in continuation of trials recommenced in 1919-20. Yields were light, the plants suffered excessively from stalk-borer, and birds caused serious depredations. These results confirm those obtained in earlier years, and where maize can universally be

grown, as in Mashonaland, there seems no good object in growing kaffir corn.

Amongst other crops which must be written down as unsuccessful were cotton, jute and unirrigated lucerne. Results with Florida beggar weed were reported upon in the October issue of the *Journal*. Variety trials and the selection of good yielding strains of dhal are still being continued, since this crop, if regarded in the right light, is one of considerable value. Systematic variety trials with sweet clovers, as hay, grazing and green manure crops were begun, but this plant does not appear at home in Rhodesia, and no results worthy of record with either annual or biennial strains were obtained.

The number of promising hay and pasture grasses of Rhodesian or African origin under observation is ever increasing. The results with these and their chief uses are, however, so varied that in order to do them justice they must be dealt with in a separate report.

For the first time on record in Rhodesia kaffir beans or cowpeas on the experiment station were attacked by a parasitic plant, *Alectra Vogelii*, Benth. It was not observable, however, that this parasite caused any injury to the host plant.

The planning, supervision, recording of field notes and the compilation of this report are the joint work of the Agriculturists, Messrs. J. A. T. Walters, C. Mainwaring and the writer. To Mr. H. C. Arnold, Assistant-in-charge, much credit is due for the excellent manner in which the station has been managed and the care with which the experiments were carried out.

[CORRECTIONS: *Rhodesia Agricultural Journal*, December, 1921:—Page 605, line 12, read 22nd December for 11th January. Page 605, Table, *Four-course Rotation No. 9*, read plus 6 tons dung per acre. Page 606, eighth line from bottom of page, read plot 10 instead of 9.]

The Cattle Industry.

By ERIC A. NOBBS, Ph.D., B.Sc.

The present phenomenal depression of the cattle market is world-wide; it is not peculiar to Rhodesia or to South Africa, and there is no reason to suppose that it is other than a passing phase, and the world's markets will probably be restored and active before the industry is so organised in this country for advantage to be taken of the return to normal conditions.

The fundamental truth that there is a shortage of meat the world over to feed the human population remains, but owing to economic causes the capacity of the consumer to buy is for the present restricted; there is, however, no doubt that sooner or later it must return to normal. The lack of demand is not due to sufficiency of supply or to ample local production in Europe, but is mainly attributable to all those influences which we to-day collectively call re-adjustment after the war. Their result is inability to purchase meat on the part of nations which, if able, would willingly do so. Hence the condition of congestion in the storages in Europe; hence the low prices and hence the herds of unsaleable cattle on our veld.

The contributory causes are many: de-valuation and re-valuation of money; increase of wages and decrease of purchasing power; strikes with all their far-reaching consequences; minor wars and political crises in many countries; droughts in England and on the Continent, forcing local stock on to the markets; and difficulties of exchange and credit.

For these reasons consumption of meat throughout the world is reduced to a minimum. Undoubtedly too there are a larger number of countries sending meat to Europe than was the case before the war. This accentuates the present position, but it is not the sole cause of the slow markets, for the increase of consumers or potential consumers has been even greater than the development of new sources of supply. It is remarkable that in Rhodesia the collapse of markets for our stock and the consequent fall in the price of live cattle have not had a more marked effect on the price paid by the ultimate consumer, that patient, much enduring yet essential factor in the question. The efforts of the Meat Producers' Exchange in the Union to effect this benefit by reducing the charges of distribution are being closely watched, but the field of its activities is remote, and here it is the farthest off that suffers first in case of a fall of price or of demand.

The collapse of the market has been greatest, most sudden and most marked in the case of tinned and preserved meats and meat

extract, the demand for these commodities having virtually disappeared. For frozen meat the situation is not so serious, and less so still for chilled beef, which may be regarded as only suffering from a passing diminution of demand and consequent reduction in price. Naturally also at such a time the best qualities and meat from the countries with the best reputation, such as the Argentine, suffer least, and it is the inferior grades of beef and the countries with the least developed trade organisation which suffer most. This is the position of Rhodesia, which can hardly be regarded as having entered the oversea trade at all, only a couple of experimental consignments having been sent away. We can hardly claim a set-back, therefore, in a trade which has never existed, but we suffer in that but for the present slump we might ere now have commenced to supply the world's markets.

The Odzi Canning Factory provided a market for a time for beasts of a quality which is unsaleable to-day. The closing of this channel accentuated the slump, but it is pleasing to note that efforts are being made to recommence operations. Meetings of the shareholders have been held in Salisbury, and an endeavour is being made to provide the necessary working capital by the issue of 15,000 Preference Cumulative £1 shares, bearing interest at 8 per cent. Payment for the shares may be made in cash or cattle; if payment is made in cattle, the following prices will be paid by the factory:—

- Grade 1 (primes): 25s. per 100 lbs. dead weight.
- Grade 2 (mediums): 20s. per 100 lbs. dead weight.
- Grade 3 (canners): 15s. per 100 lbs. dead weight.
- Grade 4 (very poor): 10s. per 100 lbs. dead weight.

At a meeting of the shareholders in January a resolution was accepted by the Directors that one-third of the payment for cattle sent to the factory would be in cash and the rest in shares. It is to be hoped that the requisite number of shares will be taken up to enable the factory to re-open, for this provides the only means to-day of disposing of our inferior class of stock. The re-opening of the factory would also tend to stabilise prices for our higher grade animals, and for this reason also the success of the effort being made is much to be desired. It is pleasing to note that the products of the company have a ready sale in the Union, and that confidence is felt that with the provision of the necessary capital the success of the factory is assured.

An important lesson for us from the present situation is that in times like the present it is the best qualities that remain least affected, both as to demand and as to variation in value. Rhodesia is still far behind the best cattle countries, but we have the consolation of knowing that the country can and will ere long produce far better stock than are to-day the rule, and that the primitive, slow maturing types are already rapidly giving place to high-class grade stock, amongst which really superior stock are no longer rare.

Rhodesia as an inland state remote from the sea labours under special disadvantages as compared to countries with their own harbours. To enable our beef to compete with that of other countries the land and ocean freights must be in ratio to similar charges from other

parts of the world and prices obtainable at the other end; that is "on what the traffic will stand" and not on a mileage basis. Above and beyond all other needs, the principal requirement of the Rhodesian cattle breeder is still bulls, and the more he has the more again he wants, and the better they are the better they have to be. This is the great desideratum.

In certain countries cattle can be finished off on artificial pasture, as is the case notably in New Zealand and in the Argentine; in others, stall feeding is the rule, as in England and over large parts of the United States and Canada. In Rhodesia, happily, both systems seem likely to come into vogue, prime grass-fed bullocks coming off our richest sweet veld in summer, whilst the poorer pastures are already sending store cattle to the grain districts for winter feeding.

The Department of Agriculture has for some years past now published the results of such hand feeding experiments and which have now been reduced to a practical system. These are followed with variations to suit local conditions by quite a number of farmers, so that this year several hundred head have been fed in this way, and if we had meat freezing works in operation no doubt the number would be multiplied many times.

Fat stock fairs at Christmas time are a recognised institution in stock-raising countries the world over. The custom is becoming established in Southern Rhodesia also, and Messrs. Schiff & Jacobson, of Gwelo, are to be complimented on the success which attended their second annual December sale and show, especially in these days of low prices and depressed markets. At such times it is only the best that continues to be profitable, and fancy figures cannot be expected. There were no buyers from the south, and all the stock—prime, medium and very compound—were disposed of for local consumption.

To ensure the presence alike of the best stock and buyers, handsome prizes were offered which brought competition from far and wide. The entries comprised 108 head of stall-fed oxen from nine different feeders scattered between Mazoe and Shangani. The Rhodes Inyanga Estates secured the award of £50 for the best pen of six oxen with grade Shorthorns which had been fattened at the Gwebi Experiment Farm. The prize for the best pen of two oxen went to Mr. C. C. Macarthur, who sent up grade Shorthorns, and one of these beasts was declared the champion ox of the show. Mr. P. O. Brocklehurst was the winner in the class for the best pen of twelve veld-fed oxen, and the Central Estates gained the award for the best pen of six slaughter cows. The better of Mr. Macarthur's two great oxen scaled 1,530 lbs. live weight at Gwelo and was bought by Mr. John Austen for £18; this beast was fed and stalled and kept till Christmas, when his dead weight was 980 lbs., or 64 per cent.

Water Power Resources of Southern Rhodesia.

(Concluded.)

By C. L. ROBERTSON. B.Sc., A.M.I.C.E., Hydrographic Engineer.

[This memorandum broadly reviews the hydrographic conditions of Southern Rhodesia and delimits certain specific areas which are worthy of detailed investigation as potential sources of water power.]

Zone E comprises the Sabi River system, which drains the eastern and southern slopes of the main divide and the western slopes of the Melssetter mountains. This zone is very important from the point of view of potential power resources, and will be best considered section by section.

(1) *Odzi River System from source to junction with the Sabi River.*—This river drains the western slopes of the mountains, and all the important tributaries enter on the left bank. The following are the most important of these streams:—

- (a) Odzi River to junction with Odzani River.
- (b) Odzani River.
- (c) Umtali River.
- (d) Impodzi River.
- (e) Wengesi River.
- (f) Umvumvuvu River.
- (g) Nyanyadzi River.

(a) *The Upper Odzi River* rises at an altitude of approximately 6,300 feet, where the mean rainfall is over 50 inches per annum. There is a through fall of 3,000 feet in the river to its junction with the Odzani River. The river is of some magnitude five miles below its source and is joined by numerous perennial tributaries throughout. Country at an elevation of 500 to 1,000 feet above the river is adjacent to it throughout its course. The whole section has therefore potential power resources, and should be investigated in detail and gauging stations established in the area.

A gauging of 180 cubic feet per second was recorded at the end of August, 1906, above the Odzani junction. This, however, was not a year of minimum river flow. From comparison with the records of flow in Odzani River, which has a similar catchment, it would be safe to assume that the Odzi River at the end of the section has an absolute minimum flow of 50 cubic feet per second. At the beginning of the

section it has a minimum flow of at least 5 cubic feet per second. The fall throughout is approximately as follows:—

5 to 10 miles	... ..	500 feet fall.
10 to 25 miles	... ..	1,300 feet fall.
25 to 40 miles	... ..	700 feet fall.

The flow is continually increased by perennial tributaries throughout the section. No good storage sites are possible in the area. The power will probably be best developed in seven 5-mile sections. There should be available in this area a minimum of 3,500 h.p. and a maximum of 14,000 h.p. (eight months).

(b) *The Odzani River* rises at an altitude of 5,700 feet, and has an average grade of 100 feet per mile for the first ten miles of its course. Below this section the Rezende Mines, Penhalonga, develop power from the river, the water being taken out in two furrows, the upper one carrying a maximum of 50 cubic feet per second, and the lower a maximum of 80 cubic feet per second. The minimum supply has never been lower than 25 cubic feet per second. In the five-mile section above the intake of the upper furrow an effective fall of 500 feet can be readily obtained. The river here can certainly be regarded as in Table I., Class E, so that there should be available a minimum of 500 h.p. and a maximum of 2,000 h.p. Below the section already utilised for power there is a through fall of 1,000 feet in the 20 miles to the junction of the Odzi River. In this section there is a grant of 17 cubic feet per second to a combined irrigation scheme serving all the irrigable land on the left bank. The irrigable land on the right bank is minor in extent. There could be made available on the section two falls, one of 100 feet and one of 150 feet, and at the tail a fall of 500 feet. The first fall is above the irrigable area. The absolute minimum flow available is 25 cubic feet per second. There is available in this section, therefore, (1) at first fall (minimum supply 25 cubic feet per second) a minimum of 250 h.p., maximum 1,000 h.p.; (2) at second fall (minimum supply 10 cubic feet per second) a minimum of 150 h.p., maximum 1,500 h.p.; (3) at tail (minimum supply 5 cubic feet per second) a minimum of 250 h.p. and maximum of 5,000 h.p.

(c) *Umtali River* rises at an altitude of over 5,000 feet. The fall available on the upper portion of its course is already utilised for power purposes by the Rezende Mines, Penhalonga. Below Penhalonga there is a fall of 600 feet in 16 miles to the Odzi River junction. It passes through a good irrigable area, and the whole normal flow is apportioned for irrigation purposes. The river therefore has no major power possibilities. It can be classified as in Table I., Class E.

Odzi River below Odzani Junction to Impodzi River.—In the section below the junction to the railway bridge there is available an effective fall of 200 feet in the eight miles. Gaugings of 180 cubic feet per second end August, 1906, above Odzani junction, and 310 cubic feet per second end September, 1917, near railway bridge, are the only records of low flow available. Neither, however, as the rainfall table shows, was in a period of minimum river flow. It will probably be safe to assume 75 cubic feet per second as absolute minimum flow available. This would permit of the possible development of 1,500 h.p. minimum

to 6,000 h.p. maximum (eight months) in this area. Below the railway bridge to the Impodzi River there is a fall of 500 feet only in 40 miles. The river is in same category as above, and has no power possibilities.

(d) *Impodzi River* has a through fall of 2,000 feet in the 25 miles of its course. Below the junction with the Shetora River it has a comparatively flat grade. Gaugings taken at end of dry period in 1906, 1915 and 1917 show that it can only be regarded as a river in Table I., Class E, and is unlikely to have major power possibilities.

(e) *Wengesi River* has a through fall of 1,000 feet in the last 12 miles of its course. It is, however, a minor stream, as a minimum flow of 2 cubic feet per second was recorded in September, 1906, and it need not therefore be considered.

(f) *Umvumvuvu River* rises at an altitude of 5,000 feet. The altitude of the drift on the Melsetter road six miles below its source is 3,830 feet. Gaugings taken in 1906, 1915, 1919 and 1921 show that it may be relied on for an absolute minimum flow of 10 cubic feet per second. An effective fall of 500 feet should be available in the section, permitting of the development of 500 to 2,000 h.p. (eight months). In the section below road drift to Nyambewa junction there is a fall of 700 feet in eight miles. There are good irrigation possibilities in the area, which are likely to absorb 10 cubic feet per second of the available minimum flow. The power potentialities in this area are therefore doubtful. Below the Nyambewa River junction to the Odzi River there is a fall of 1,000 feet in 12 miles. There will be available, allowing for irrigation development above, a minimum of 10 cubic feet per second, and an effective fall of at least 500 feet can be reckoned as available, as there is high country on the left bank. This will permit of the development of 500 to 2,000 h.p. in the area.

The Nyamadzi River rises at an altitude of 6,000 feet, and has a total fall of 3,900 feet on the 35 miles to its junction with the Odzi River. There is considerable irrigation practised on the first 20 miles, and it is probable that the last section of 15 miles, where it passes through a native reserve, is the only portion available for power. The only record of flow available in this section is one taken at the end of 1915, which showed a discharge of 40 cubic feet per second. Allowing for irrigation use above, it is probable that a minimum of only 10 cubic feet per second could be relied on continually, and a maximum of 40 cubic feet per second for eight months in the year. The whole of the last 15-mile section should be investigated. It is probable that there is available here at least a minimum of 500 h.p. and a maximum of 2,000 h.p.

Odzi River from Impodzi River to Sabi River.—The river in this section has a fall of only 400 feet in the 30 miles. No marked rapids or falls have been noted, so it is probably on a fairly even grade throughout. Below the Umvumvuvu junction the river can be relied on for a minimum discharge of 100 cubic feet per second, but the necessary fall conditions for power are not available.

The Sabi River System comprises the three main rivers, the Sabi, Rusawi and Machike.

The Machike River rises at an altitude of 5,000 feet. It is a minor stream in years of low flow up to its junction with the Lesapi River. Below this point it can be regarded as in Table II., Class C, and the necessary fall condition is unlikely to be fulfilled.

The Rusawi River rises at an altitude of 5,300 feet. For the first 35 miles up to its junction with the Weninibi River it is a minor stream in years of low flow. The through fall is 1,300 feet, so the necessary fall is unlikely to be available. Below this point it can be regarded as in Table II., Class D, but it is not considered that the necessary fall conditions can be fulfilled. In the ten-mile section below the junction of the two rivers to the Sabi River, the river can be regarded as in Table II., Class E, and is worth investigation. A sharp fall of 150 feet is known immediately below the junction of the rivers. It is extremely probable that an effective fall of 360 feet will be available therefore in the ten miles. This would permit of the development of 1,600 to 6,400 h.p.

The Sabi River has its source at an altitude of 4,800 feet, and has a through fall of approximately 2,000 feet in the 70 miles to the Machike River. No information is available regarding the river in this section, but it is unlikely to be better than Table II., Class D, without the probability of having the requisite fall available.

Below the junction of the Machike River there is a through fall of 1,000 feet in the 50 miles to the Odzi River. If the power storage scheme on the Machike River were installed above there would be power possibilities in this section, as a minimum flow of 60 cubic feet per second would be available. This section therefore is worth investigation. The probable power available is 2,000 minimum, 8,000 maximum h.p.

The Sabi River from Odzi River to Dcuruli River has a fall of 100 feet only in 15 miles, and an absolute minimum flow of 150 cubic feet per second can be relied on, but owing to the low grade there are no power possibilities.

The Dcuruli River System comprises as the two main rivers the Nyazidza and Devuli. The Nyazidza River drains an area which is subject to big fluctuations in the annual rainfall. Nothing is on record regarding the flow of the river, but its absolute minimum is unlikely to be as much as 5 cubic feet per second, and power possibilities are not probable even with storage. The Devuli River has only a minor flow in its upper reaches, but below the junction of the Mungesi River it is possible the area may be worth investigation. Below the junction of the Nyazidza River the Devuli River is believed to have a comparatively steep grade, and there are probably power possibilities in this section too, but no information is available at present.

The Sabi River from Devuli River to Lundi River has a through fall of 800 feet only in 80 miles. It is joined by two important tributaries in this section, viz., Tanganda and Turgwi, both draining areas of high rainfall. Gaugings on the Tanganda River above junction of 15 cubic feet per second (20.9.06) and 30 cubic feet per second (10.10.15) exist. One gauging of the Turgwi River above junction of 55 cubic feet per second was taken on 5th November, 1915 (unaffected

by rain). Both of these rivers have a steep grade, and are probably in Table I., Class D and E respectively. There are probably power possibilities on each of them on the 15-mile sections above the junctions. Gaugings on the Sabi River in this section were taken in October, 1906 and 1915, and the absolute minimum flow below the Turgwi River is probably 200 cubic feet per second. The only place where necessary fall conditions can be fulfilled is at the Chiribiri falls 30 miles below the junction of the Turgwi River. Here an effective fall of 100 feet in $\frac{1}{2}$ mile is known, rendering possible a minimum of 2,000 and a maximum of 8,000 h.p.

The Lundi River System includes four main rivers, viz., Lundi, Tokwe, Mtilekwe and Chiredzi. *The Lundi River* has two main tributary streams, viz., Umtebekwe and Little Umtebekwe Rivers, which drain the hilly country round Selukwe, which has a mean annual rainfall of 35 to 40 inches. Above their junctions with the Lundi they may be regarded as in Class E, Table I., and it is probable that on the ten-mile section above their junctions conditions will permit of the development of 300 to 1,200 h.p. on each of them. On the section below the junction of the Little Umtebekwe River to the Ingesi River, it is not probable that the necessary fall conditions for power development can be fulfilled. The river in this section can be regarded as in Table II., Class E. On the section from Ingesi River to the Tokwe River there is a through fall of 1,100 feet in 60 miles. On a 20-mile section 40 miles above the Tokwe junction a fall of 600 feet is available with storage possibilities above the section. The river is still in Class E, but it should be possible with storage to develop 2,500 to 10,000 h.p.

The Tokwe River, until it passes the hilly country around Zimbabwe in south Victoria district, has only a small permanent flow. The river below this area is in Class E, Table II. On the 15-mile section above, where the river divides into the Tokwani and Tokwe, it is probable that the necessary fall conditions can be fulfilled which would permit of the development of 1,500 to 6,000 h.p.

The Mtilekwe River drains the area between Victoria and Ndanga. Above the junction of the Umshagashi River there are possibilities of big irrigation development in the future; good storage sites are known to exist, which will, however, be needed for irrigation purposes probably. On the section below Umshagashi junction to the Lundi River there are localities known with the requisite fall conditions, but owing to the probable prior claims of irrigation it is not considered that this river has major power potentialities.

The Lundi River, from the Tokwe River to the Sabi River, has a fall of only 600 feet in 70 miles. On one section 10 miles below Mtilekwe junction the river passes through a narrow gorge 12 miles in length, in which the total fall amounts to 250 feet. Good storage exists immediately above the gorge. If this storage is utilised in conjunction with the flow from the two upper schemes, there would be available here a minimum of 120 cubic feet per second and a working head of 200 feet. The possibilities in this area are therefore 2,400 to 9,600 h.p. Below this point to the Sabi the grade is flat, and there are no power possibilities.

Zone F comprises the rivers draining eastward from the border mountain chain. The main rivers in this zone are the Gaerisi, Pungwe, Lusitu and Busi. The whole zone is an area of high annual rainfall, averaging approximately 50 inches. There are a number of smaller streams with grades of 100 feet per mile. They are mostly in Class D, Table II., and whilst in the aggregate a large amount of power is available from these streams, it will be developed in small units, and it is impossible to consider them in a report of this nature.

The Gaerisi River drains the eastern slopes of the Inyanga mountains, and is the border between Rhodesia and Portuguese territory for some distance. It is in very inaccessible country, but is of considerable importance for power development. Only one gauging exists at a point 35 miles below its source, taken on 15th August, 1917, when a flow of 560 cubic feet per second was recorded. No details of grade are known, but it is probable that the grade of the river is 100 feet per mile for the first 15 miles, and an average of 50 feet per mile for the remainder of its course. The whole area should be investigated in detail, as a minimum of 10,000 h.p. is quite likely to be possible on this river.

The Pungwe River may be classed in Class E, Table I., 10 miles below its course. A fall of over 500 feet is available here, and an effective fall of 600 feet to the end of the gorge can be obtained. At this point there is available 600 to 2,400 h.p. The river continues for another 15 miles to the border, and probably has further power possibilities of which no details are available.

The Lusitu River, below the junction of its tributary the Nyhodi River, is of some importance, but as it flows through an area on which considerable irrigation development is possible, it would require detailed investigations to decide its power possibilities.

The Busi River is in a similar position, and no details are available.

The Honde River and Mazonwe River in this zone have power possibilities of which the magnitude is not known. Outside of these zones there are in addition the Limpopo and Zambesi Rivers to be considered.

The Limpopo River, on the section adjoining this territory, has too flat a grade to permit of power development.

The Zambesi River has potential power possibilities at Victoria Falls, Kariba Gorge and Mapata Gorge. The Zambesi River at Victoria Falls was gauged during April-December, 1905, and the average flow recorded was 11,700 cubic feet per second. This was a year of low flow, so it is probable that 7,500 cubic feet per second may be accepted as the available minimum flow. The effective head available at the falls is 300 feet, which will permit of the development of a minimum of 225,000 h.p. The fall available at Kariba Gorge has been given as 130 feet, of which probably 100 feet can be reckoned as effective. This will permit of the development of a minimum of 75,000 h.p. in this locality. No details are available of the fall at Mapata Gorge, but it is considered that the estimate of 10,000 h.p. minimum is a safe one.

SUMMARY OF POTENTIAL HORSE POWER AVAILABLE.

No.	Zone.	River.	Without storage.		Cost per average H.P.	With storage.		Cost per average H.P.
			Min. H.P.	Max. H.P.		Min. H.P.	Max. H.P.	
1	C	Sanyati ...	...	...	£ ...	2,000	8,000	£ 49.0
2	C	Hunyani ...	...	...	...	2,600	10,400	31.0
3	C	Angwa ...	...	...	...	1,400	5,600	48.0
4	D	Wengi ..	150	600	10.0	...	...	...
5	D	Mazoe ...	400	1,600	10.8	1,800	7,200	30.1
6	D	Umwindzi	...	.	...	1,400	5,600	25.5
7	D	Inyagui .	...	...	...	1,500	6,000	27.8
8	D	Inyagui ...	...	Utilising storage flow from (6) and (7).	...	2,800	11,200	31.9
9	D	Mazoe ...	...	Utilising storage flow from (5), (6) and (7).	...	4,250	17,000	34.8
10	D	Nyagadzi ...	400	1,600	10.8	...	...	...
11	D	Inyangombi	1,000	4,000	4.0	...	...	...
12	D	Inyangombi	3,000	12,000	16.7	...	...	...
13	D	Ruenya ..	No estimate.	...	...	...	...	...
14	E	Odzi ...	3,500	14,000	9.3	...	...	...
15	E	Odzani ...	500	2,000	5.3	...	...	...
16	E	Odzani ..	650	7,500	11.0	...	...	...

17	E	Odzi ...	1,500	6,000	18.3	..	..	..
18	E	Umvumvuvu	500	2,000	5.3	..	..	..
19	E	Umvumvuvu	500	2,000	6.0	..	..	..
20	E	Nyanyadzi	500	2,000	..	..	..	..
21	E	Machike ...	...	...	..	1,600	6,400	34.0
22	E	Sabi ...	...	...	Utilising storage flow from (21).	2,000	8,000	41.0
23	E	Devuli ...	...	No estimate.	..	..	..	..
24	E	Sabi ...	2,000	8,000	6.7	..	..	..
25	E	Umtebekwe	300	1,200	16.7	..	..	..
26	F	Little Umtebekwe	300	1,200	..	..	..	..
27	E	Lundi ...	600	2,400	12.8	2,500	10,000	40.7
28	E	Tokwe ...	300	1,200	20.0	1,500	6,000	40.2
29	E	Lundi ...	600	2,400	25.0	2,400	9,600	48.0
30	F	Gaerisi ...	...	Probable min. 10,000.	No estimate.	..	..	..
31	F	Pungwe ..	600	2,400	4.4	..	..	..
32	A	Zambesi ..	225,000	225,000	..	..	..	..
33	A	Zambesi ..	75,000	75,000	..	..	..	..
34	A	Zambesi ...	10,000	10,000	..	..	..	..
		Total ...	327,300	383,700	..	27,750	111,000	..

The above summary is to be regarded merely as a first approximation to the potential amount of water power in the territory as framed from the rather sketchy data available. It is believed, however, that it will serve a useful purpose in defining the possible areas and in furnishing a comparison between them of their relative magnitude and cost. The estimate of river flow adopted is in all cases a safe and conservative one. Detailed investigation of these areas will probably disclose more favourable conditions of grade on shorter sections than those adopted, and this would materially reduce the unit cost. It is intended during the next few years to instal gauging stations on the rivers above most of these areas and to obtain more precise details of the grade.

Water Legislation.—In Southern Rhodesia the control of all water flowing in natural channels other than that required for primary use is vested in the State. The use of water for power purposes is specified as a tertiary use and is subservient to the use of water for irrigation purposes. Any water right granted can be cancelled if it has not been utilised for a consecutive period of three years.

The annual hydrographic reports will contain information as to the amount of normal flow apportioned for irrigation use above these potential power areas and amount of normal flow available. Reports on further detailed investigations in these areas will also be included.

Crop Experiments, 1921-22.

The following brief summary of the more important crop experiments in progress this year on the Salisbury Experiment Station and the Gwebi Experiment Farm is published in order that farmers may keep in touch with the work in progress:—

SALISBURY EXPERIMENT STATION.

Maize.

- (a) Variety trials with flat white varieties: Potchefstroom Pearl, Eureka White, Menne, Salisbury White, Hickory King, etc.
- (b) Distance planting trials for grain and for fodder.
- (c) Date of planting trials.
- (d) Cultural trials with maize intersown with various legumes for silage.
- (e) Rotation experiments demonstrating:—
 - (1) effect of bare fallowing in alternate years;

- (2) effect of rotating maize with legumes and fine straw crops;
- (3) maize in a four-course rotation; land receiving farmyard manure once every four years;
- (4) demonstration of practical rotations for the maize grower with three-quarters of the land planted each year to maize;
- (5) comparison between continuous maize and maize alternating with sunflower.
- (f) Comparison of results with maize grown from seed from rough and smooth ears of the same variety; from seed from long ears and short ears; from seed from ears with well covered tips against ears with tips protruding through the sheath.
- (g) Transference of seed from black to red soil.
- (h) Transference of seed from low to high veld.
- (i) Effect of use of seed infected with brown fungoid spot.
- (j) Maize crops undersown with oats, beans, dhal and Niger oil.
- (k) Consistency of row numbers in selected strains of maize.
- (l) Yields from perfect stands compared with those from stands with a known percentage of plants removed.

Maize Manurial Trials.

- (a) Effect of manurial applications based on results of previous trials.
- (b) Effect of a combination of green manuring and various fertilisers.
- (c) Effect of application of farmyard manure.
- (d) Effect of ploughing in the whole of a green crop compared with ploughing in the stubble only. (Velvet beans, Niger oil, Sunn hemp and yellow lupins.)
- (e) Effect of green manuring with legumes as compared with non-legumes.
- (f) Effect of burning off previous crop of Sunn hemp and hibiscus, as against ploughing crop under.
- (g) Effect of application of lime with and without green manures.
- (h) Comparative amounts of plant food added to the soil by various green manure crops.

Variety and Cultural Trials—Other Crops than Maize.

Beans (30), ground nuts, dhal, linseed, oats, millets, kaffir corns, root crops, buckwheat, poppy, potatoes, pumpkins, sweet clovers, lucerne varieties, cotton, *hibiscus cannabinus*, jute, peas, sweet potatoes.

Hay Crops.

Teff, manna, Sudan grass, oats for hay, wheat and oats for hay. Sudan grass, oats and peas; teff, oats, Sudan grass and peas.

Pasture Plants, Fodders and Grasses.

Napier fodder, Indian cane, cow cane, umfufu, kudzu vine, sweet clover, lucerne, beggar weed, kikuyu, African star grass; Guinea grass and sixty varieties of natives grasses showing greatest promise as hay or pasture grasses.

CWEBI EXPERIMENT FARM.**PARTICULARS OF EXPERIMENTS IN PROGRESS, 1921-22.**

Rotation Experiments—Plots three acres each in area.

Series Commenced 1915-16.

Course A, Plot A.—Maize once in seven years. Rotation—*sweet potatoes, linseed, velvet beans, majortas, ground nuts, Sudan grass, maize.*

Course B, Plots 1-3.—Maize twice in three years. Rotation—*majortas, maize, maize.* Majortas receive 8 tons dung per acre. Maize furthest from majorta in rotation receives complete artificials.

Course C, Plots 4-6.—Maize once in three years. Rotation—*velvet beans, mangels, maize.* Mangels with 8 tons dung per acre. Maize receives complete artificials.

Course D, Plot B.—Maize continuous. Plot received complete artificials 1915-16 and 6 tons dung per acre 1917-18.

Course E, Plots 7-12.—A six-course rotation. Maize every second year. Rotation—*maize, majortas, maize, velvet beans, maize, oats.* Majortas receive 8 tons dung per acre. Maize following oats receives complete artificials. Velvet beans reaped.

Series Commenced 1917-18.

Course F, Plot C.—Maize every second year. Maize alternates with any bean crop other than velvet beans. At present the bean used is Tepary.

Course G, Plot D.—Maize every second year. Maize alternates with velvet beans, which are reaped.

Course H, Plots 13-16.—Maize every fourth year. Rotation—*maize, velvet beans, oats, mangels.* Mangels receive 8 tons dung per acre. Velvet beans reaped.

Course K, Plots 17-20.—Maize every fourth year. Rotation—*mangels, oats, velvet beans, maize.* Mangels receive 8 tons dung per acre. Maize receives complete artificials. Velvet beans are reaped.

Series Commenced 1919-20.

Course L, Plots 21-24.—Maize three times in four years. Rotation—*maize, maize, maize, velvet beans* ploughed under. The second crop of maize after the green manuring receives complete artificials.

Course M, Plots 25-28.—Maize three times in four years. Rotation—*maize, maize, maize, sweet potatoes.* Maize preceding sweet potatoes receives 8 tons dung per acre. Maize following sweet potatoes receives complete artificials.

Course N, Plots 29-33.—Maize three times in five years. Rotation—*maize, maize, maize, velvet beans, oats.* The second crop of maize receives complete artificials, *i.e.*, the land receives artificials once every five years. Velvet beans are reaped for seed.

Course O, Plots 34-38.—Maize four times in five years. Rotation—maize, maize, maize, maize, velvet beans ploughed under. Maize fertilised as in Course N. Land receives artificials once every five years.

The total area planted this year to maize for grain is 225 acres, of which 163 acres is sown to Salisbury White, 50 acres to Hickory King and 12 acres to Potchefstroom Pearl.

Eleven acres are occupied by fertiliser trials with maize carried out in co-operation with the Chief Chemist on 1/20th acre plots. Each treatment is tested in quadruplicate and numerous control plots are provided.

Crops Other than Maize.

Other main crops on the farm are: Mangels, 9 acres; Kherson oats, 23 acres; velvet beans, 64 acres; majortas, 12 acres; sweet potatoes, 4 acres; Niger oil, 13 acres; sunflower, 11 acres; Sunn hemp, 23 acres; peas, 13 acres; maize and velvet beans for silage, 25 acres; potatoes, 6 acres; manna, 13 acres; pumpkins, 6 acres; teff grass, 18 acres; Sudan grass, 11 acres; ground nuts, 27 acres; linseed, 8 acres; Tepary bean, 8 acres; buckwheat, 5 acres.

The above sowings comprise variety trials with potatoes, date of planting trials with velvet beans, method of planting trials with mixed crops of maize and velvet beans, the effect of previous crops on a following crop of ground nuts, and the effect of turning under a full growth of Sunn hemp as a green manure compared with ploughing under the roots of the plant only.

Winter Pastures.

The following pasture grasses are under trial on poor gravelly red soil: Molasses grass, laid down 1917-18; Kikuyu grass, 1920. Areas of Tussock grass, African star grass, buffel grass, Rhodes grass, buffalo grass, kudzu vine and an additional acreage of Kikuyu and molasses grass have been laid down this season.

On heavy black soils adjoining the Gwebi River the following grasses have been established this year: *Paspalum dilatatum*, *Paspalum virgatum*, *Paspalum scrobiculatum*, *Phalaris bulbosa*, Buffalo grass. Swamp couch grass (*Hamarhria fasciculata*). Rhodes grass, Kikuyu. African Star grass and Tussock grass.

Manures and Fertilisers.

Not including the Chief Chemist's artificial fertiliser trials, the manures used on the farm this year are 170 tons of farmyard manure and 2½ tons of complete artificials costing about £16 per ton. These quantities agree very closely with those used last season, when the average maize yield for the whole farm was 11 bags per acre.

Arlington Sand Veld Experiment Station.

FIRST REPORT.

(Concluded.)

WINTER CROPS, 1921.

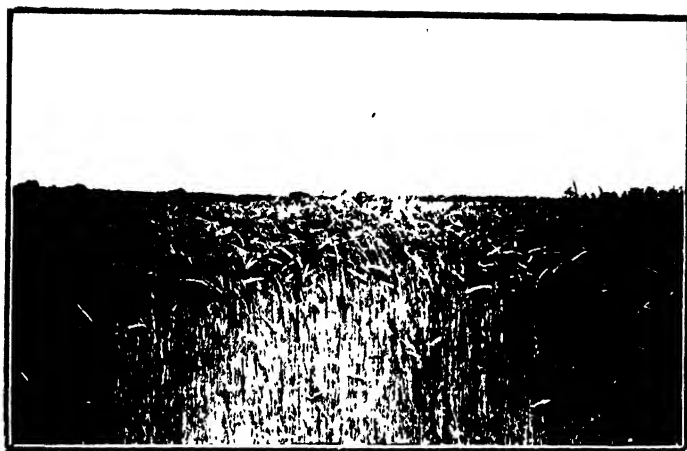
By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist, and
E. E. WRIGHT, Station Manager.

RYE.

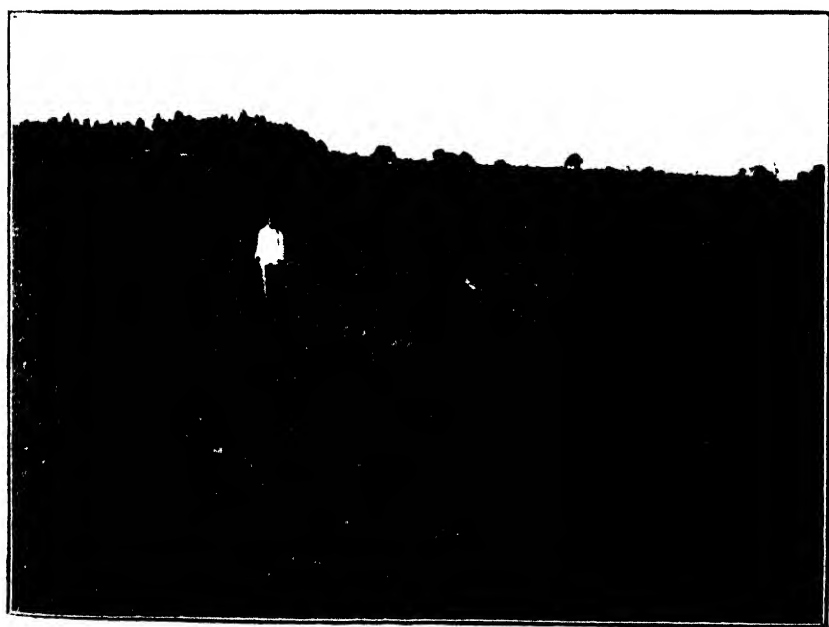
Plot No. 10.—Six acres Cape Early, drilled 7th June, 50 lbs. seed per acre. Soil consisted of an extremely poor white sand which was not ploughed until April. It was then disc harrowed and again ploughed and disced early in May. No fertiliser applied. Rolled and harrowed after sowing. Germination was good, but subsequent growth very poor. Soil retained its moisture fairly well, but was too poor to promote vigorous growth. A few ears began to show 6th September, and as there was no prospect of crop maturing grain it was ploughed under. In appearance the soil resembled sea sand, and it was remarkable that any crop was able to grow on it. During August the plot would have yielded quite good grazing.

Plots Nos. 17-18.—One acre Cape Early, drilled 7th June. Soil black sand; better than that of plot No. 10. Half plot fertilised with complete artificial fertiliser, half untreated. Germination good, and plants stood fairly well; subsequent growth good. The soil retained its moisture very well. Ears began to show 27th July, and stand was in full ear middle of August. Average height of straw 3 feet 6 inches. Part fertilised showed slight improvement over the part untreated, the straw being taller and ears slightly larger. Reaped 27th October. Yield 400 lbs. grain per acre. The rye on this plot did well, and would have yielded a splendid cutting of green fodder. In parts the straw was over 4 feet high. The grain return was disappointing.

Plot No. 27.—Half acre Cape Early, drilled 14th May. The soil, a poor grey sand containing a good deal of clay, was ploughed and



Cape Early Rye Arlington Experiment Station September, 1921.



Rye at Arlington Experiment Station. 23rd June, 1921.

disc harrowed during April and cross ploughed and harrowed again beginning of May. Half the plot was fertilised and half untreated. Germination was good, but plants stooled poorly, and subsequent growth was weak. The soil retained moisture indifferently, the lower and more clayey end of the plot in particular drying out very badly. Ears commenced to show 27th July. In full ear middle of August. Average height 2 feet, but a very thin sparse stand. Reaped 15th October. *Yield 100 lbs. grain per acre.* In spite of the very low grain return, this plot in the middle of August would have yielded a good cutting of green fodder.

Plot No. 23.—Two acres Cape Early, 60 lbs. seed per acre, drilled 17th May. Soil same as for plot 27. Once ploughed and disc harrowed during April and disced again before sowing. No fertiliser used. Germination fair, but plants did not stool well; subsequent growth poor, and extremely so on the lower half of the plot, where the soil dried out badly. Ears began to appear on 27th July, and stand was in full ear middle of August. Average height 2 feet 6 inches. Ripe 15th October. Reaped 24th October. *Yield 195 lbs. grain per acre.* This plot again would have given a good cutting of green fodder early in August.

BARLEY.

This cereal, probably owing to being shallow-rooted, did very poorly in all plots. It was apparently unable to withstand the drying out of the soil. While moisture was still retained it did well, but from the end of July onwards it began to show the effects of drought. The crop is evidently not as hardy on these soils as wheat, oats, rye and emmer.

Plot No. 16.—Half acre Smyrna barley, drilled 11th May, 60 lbs. seed per acre. Soil was a good black sand. The plot was once ploughed and disced during April. Half the plot was fertilised with complete artificials. Rolled and harrowed after sowing. Harrowed again end of June. Germination was good, and plants stooled fairly well, but later growth was poor. Soil retained its moisture moderately well. Ears began to show beginning of August, and stand was in full ear the middle of that month. Average height 18 inches. Ripe and reaped 24th October. Fertilised portion showed no improvement over the untreated part. *Yield 50 lbs. grain per acre.* Would have given a fair cutting of green fodder.

Plot No. 34.—Two and a half acres Smyrna barley, drilled 9th June. Soil consisted of dark sand and was in fairly good condition. It was ploughed and disc harrowed in March, cross ploughed and disced again in May. Half the plot was fertilised with complete artificial fertiliser, half was untreated. Rolled and harrowed after sowing. Harrowed again end of June. Germination was good, but subsequent growth very poor. Soil retained its moisture moderately well. Commenced heading 28th August. Ears were small and did not fill. Would have given a light cutting of green fodder. Ploughed under.

Plot No. 26.—Half acre Smyrna barley, drilled 14th May. Results same as for plot 34. Ploughed under.

OATS.

In these trials the quick maturing or early varieties consistently showed to advantage, and the later the variety the poorer the result. All land sown to oats was ploughed in March and cross ploughed and harrowed again in April. Sowing was at the rate of 60 lbs. seed per acre.

Plot No. 29.—Two acres Winter Dunn oats, drilled 5th May. Soil consisted of a poor white sand. Half plot fertilised with complete artificial fertiliser and half untreated. Rolled and harrowed after sowing and harrowed again end of May. Germination was fair, but subsequent growth very poor. Soil dried out excessively at the end of August and crop began to wither off without piping. In consequence was ploughed under.

Plot No. 25.—One acre Winter Dunn oats, drilled 14th May. Treatment and results same as for plot No. 29.

Plot No. 31.—One acre Early Burt oats, drilled 5th May. Soil consisted of dark sand and was in fair condition. Half plot was fertilised with complete artificial fertiliser and half was untreated. Germination fair, subsequent growth good, stood fairly well. Soil retained its moisture well except at the higher end of the plot, where, on an antheap, it dried out rapidly. Ears began to show 27th July, and stand was in full ear middle of August. Average height 2½ feet. No improvement on fertilised portion. Ripe and reaped 15th September. Yield 385 lbs. grain per acre. Late rains in May, the day after this plot was sown, rendered the land extremely wet, and caused a good deal of the seed to rot. This oat did the best of any variety under trial, and would have yielded an excellent cutting of green fodder or oat hay. It could have been cut green at the beginning of August.

Plot No. 33.—One acre Kherson oats, drilled 17th May. Soil and treatment same as for plot No. 31. Germination fair, stood moderately well, and subsequent growth good. Soil retained its moisture well. In two places the land was very wet when sown, and on these the seed rotted without germinating. Ears began to appear 29th August, and plot was in full ear the middle of September. Average height of straw 2 feet. No improvement where fertilised. Reaped 10th November. Estimated yield 150 lbs. grain per acre. This oat would have given a very fine crop of green fodder or grazing. Possibly due to poverty of soil a number of ears failed to set grain. In the neighbourhood of an antheap the ears were large and very well filled. Would probably have done better if sown earlier, from middle to end of April.

Plot No. 30.—One acre Lachlan oats. Drilled 5th May. Soil a light sandy clay of poor quality. Half plot fertilised with complete artificial fertiliser, half untreated. Could not be rolled and harrowed after sowing, as land was then too wet. Harrowed end of May and again end of June. Germination fair, and subsequent growth fair. Soil did not retain its moisture at all well, and began to dry out just as oats began piping. First ears appeared 28th August. In full ear middle of September. Average height of straw 2 feet. Fertiliser showed no improvement on portion untreated. Reaped 15th October. Yield

130 lbs. grain per acre. This oat is a slower maturing variety, and at no time did as well as Burt or Kherson. It would have done better if soil had not been excessively wet at time of sowing, and had not subsequently dried out so rapidly.

Plot No. 32.—One acre Algerian oats, drilled 6th May. Soil poor light sand; treatment as for plot No. 30. Could not be rolled and harrowed after sowing on account of late rains having made land excessively wet. Harrowed end of May and again end of June. Germination fair. Subsequent growth poor. Soil retained its moisture fairly well, but dried out before the crop began to pipe. First ears appeared 27th August. In full ear middle of September, but a very poor thin stand. Cut for fodder for oxen and no weights taken. This oat is a slow maturing variety, and the soil had dried out before it could reach maturity. Would have provided useful grazing, and would have done better if either sown earlier or if soil had been more retentive of moisture.

EMMER.

Plot No. 36.—Two acres emmer, 60 lbs. seed per acre, drilled 5th July. Soil black sand in fairly good condition. Fertilised with complete artificial fertiliser. Rolled and harrowed after sowing. Germination good, plants stooled well, and subsequent growth was good. Soil retained its moisture fairly well. First ears appeared 19th October. In full ear end of October. Average height of straw 2 feet. Not reaped at date of writing this report. This crop, as will be realised, was sown much too late, but in spite of this has done remarkably well, and during September would have provided most excellent grazing. At a later date it would have given a good cutting of green fodder, and for these two purposes and on this class of land it seems a crop of great promise if sown in early April.

Forty-seven other varieties of wheat, five varieties of oats, two of barley and two of rye were also grown in row trials—two rows of each. Nearly all the wheats did moderately well, and some are exceptionally promising. These will be grown on larger plots next season. None of these varieties failed, though some do not more than justify their being tried once again in row cultures next year. Of the oats, only Kherson and an unnamed selection did well. The rye varieties were good, and the barleys again failed.

OTHER CROPS.

In addition to the cereals already enumerated, plots of varying size were also laid down to the following crops:—Linseed, vetches, peas (Black-eyed Susan and Yorkshire Hero), gram or chick pea. Vetches failed entirely; linseed, probably on account of the poorness of the soil, grew fairly well, but only gave a yield of seed equal to that sown. Black-eyed Susan peas, sown 12th May in rows 3 feet apart, made a good growth of haulm 2 feet high, but only yielded 135 lbs. dry peas per acre. A later sowing on 27th June, in rows 2 feet apart and on land very lightly dressed with kraal manure, made similar growth, but when reaped on the 10th October gave a return of 240 lbs. clean seed per acre. Yorkshire Hero pea, drilled 12th May in rows 18 inches

apart on unmanured land, was reaped on 5th September, and also gave 240 lbs. seed per acre. Gram sown in rows 18 inches apart on the 6th June made remarkably good growth, and gave a yield of 432 lbs. seed per acre. This leguminous crop promises to be of particular value on the class of soils now reported upon.

Twelve $\frac{1}{2}$ acre plots were sown or planted to the following crops:—Drumhead cabbage, Chinese cabbage, Thousand Head kale, Dwarf Essex rape, swedes, Purple Top turnips, mangolds, field radish, carrots, white mustard and horse beans. For reasons already explained, the land was not ready to receive these crops until early June. It was ploughed in March, cross ploughed and disced at end of May, and a light dressing of kraal manure was spread in the drills at the time of seeding or planting. Drumhead and Chinese cabbage were raised in seed beds and planted out 27-28th May. Thousand Head kale, Dwarf Essex rape, swedes, turnips, mangolds and carrots were treated as follows:—Half of each plot was sown *in situ* and the other half planted with plants raised in a seed bed. In all cases both seed sown *in situ* and transplants were put in between the end of May and end of June. Field radish sown *in situ* 2nd June, mustard 4th June, horse beans 8th June. Considering the late date at which all these crops were established, results were most encouraging, especially in the case of Thousand Head kale, Dwarf Essex rape and turnips. The Drumhead cabbage and Chinese cabbage grew fairly well, but the first-named, though reaching an average height of 12 inches and making plenty of leaf growth, failed to form heads. The latter also, probably from being sown too late and the weather becoming too hot, ran at once to seed. Swedes and mangolds were obviously much too late in being put in, and made little growth. Field radish, carrots and turnips did very much better, and made fair sized roots, though the radish rapidly ran to seed as the land dried out and the weather became hotter. Horse beans made but poor growth, and mustard died off after reaching a height of 6 to 10 inches.

Of these crops, and in spite of late sowing, Thousand Head kale, rape, Drumhead cabbage, field radish and turnips would have given profitable returns for feeding off in September and October.

There is no reason to doubt that mangolds, swedes and cabbage would have done really well had the land been more heavily manured, and had the seed been sown or the plants transplanted in early April. It is not apparent yet which method of sowing is most to be recommended. Indeed, in framing this, the first report on this station, the object is more to place on record the very encouraging results which have been obtained within nine months of operations being begun, than to attempt any definite recommendations regarding the best system of soil or crop management. In spite of extreme rawness of land, want of knowledge of the moisture-retaining capabilities of the soil, lack of farmyard manure, and in most cases late date of seeding, only four crops—linseed, vetches, horse beans, and to some extent barley—out of the many different kinds tested, showed little or no promise. This fact is no small testimony to the great possibilities of granite vlei soils without irrigation when once they are well worked down and their fertility has been improved by manuring and green manuring.

Limestones in Southern Rhodesia.

By G. N. BLACKSHAW, O.B.E., B.Sc., F.I.C., Chief Chemist,
Department of Agriculture.

A review of the knowledge which has been gained from analyses carried out at the Chemical Laboratory of the Department of Agriculture concerning the composition of Rhodesian limestones will not only be of interest, but also of value in supplying information concerning their occurrence and quality. Whilst 65 samples of limestones, travertines and "lime-bearing" rocks have been analysed, it is not inferred that this chemical survey of limestones occurring in the Territory is complete, for there are several deposits of very good quality now being worked commercially for the production of "burnt" lime, samples of which have not been submitted to the Agricultural Department for examination, and which are, consequently, not referred to in this article. In dealing with the samples examined, it is proposed to classify the deposits according to composition in the following groups:—

- (1) Limestones containing over 80 per cent. calcium carbonate (carbonate of lime).
- (2) Lime-bearing rocks containing less than 80 per cent. calcium carbonate.
- (3) Travertines (vlei limes) containing in air-dried condition over 80 per cent. calcium carbonate.
- (4) Travertines (vlei limes) containing in air-dried condition less than 80 per cent. calcium carbonate.

It may be explained at this point that travertine is of very common occurrence in this Territory, such deposits being derived from epidiorite, basalt, dolerite, serpentine and other basic rocks. Several deposits of travertine are now being worked on a small scale, the term "vlei lime" being commonly applied thereto because they are generally situated in vleis at or near the surface. In accordance with the above classification, the rocks represented by the 65 samples examined are set forth in the following tables, with particulars of the districts and in most cases the exact localities from which the samples were obtained:—

RHODESIAN LIMESTONES CONTAINING OVER 80 PER CENT. CALCIUM CARBONATE.

Lab. No.	District.	Silica and refractory silicates.	Iron oxide and alumina.	Calcium carbonate	Magnesium carbonate.	Locality.	Remarks.
14a	Salisbury...	per cent. 5.76	per cent. 0.92	per cent. 90.73	per cent. 1.26	Chishawasha	
580	Bulawayo .	13.16	0.46	83.93	0.84	M'nonda farm, Bulawayo	
243	Makoni ...	8.08	0.46	91.32	...	20 miles W. of Odzi ...	Chiefly calcite
463G	Mazoe ...	10.14	3.99	84.10	1.51	Marston farm, Bindura	
470G	Victoria ...	2.40	0.67	94.66	0.62	St. Swithin farm	
471G	Victoria ...	5.72	0.83	90.40	2.09	St. Swithin farm	
472G	Victoria ...	0.08	0.41	98.89	0.65	St. Swithin farm ...	Calcite
226	Bulawayo .	12.17	0.76	83.60	..	Felix farm, Bulawayo	
16a	Salisbury...	0.64	...	96.37	0.62	Kilmuir farm	
243	Gwelo ...	...	...	91.18	1.55	Glencraig farm	
244	Gwelo ...	...	...	84.21	1.50	Glencraig farm	
5	Gwanda ...	...	...	83.95	...		

RHODESIAN LIME-BEARING ROCKS CONTAINING LESS THAN 80 PER CENT. CALCIUM CARBONATE.

Lab. No.	District.	Silica and refractory silicates.	Iron oxide and alumina.	Calcium carbonate.	Magnesium carbonate.	Locality.	Remarks.
210	Hartley ..	per cent. 4.37	per cent. 0.21	per cent. 50.85	per cent. 44.58	1690½-mile peg, Bulawayo-Salisbury line	Dolomite
271	Wankie ..	19.18	3.55	51.75	23.18	1552½-mile peg, Bulawayo-Victoria Falls line	Dolomitic
272	Wankie ..	28.21	2.75	68.82	very small	1552½-mile peg, Bulawayo-Victoria Falls line	Dolomite
45G	Lomagundi	20.02	0.20	41.85	37.82	Kasoko farm ...	Dolomitic
277	Gwelo ...	20.33	9.60	64.73	2.56	...	Dolomite
205	Melsetter...	...	...	24.46	90.93	Near Tanganda River, South Melsetter	Dolomitic
206	Melsetter...	41.36	1.09	57.33	0.25	Near Tanganda River, South Melsetter	Dolomite
8	Lomagundi	2.42	...	54.23	43.26	Sinoia caves ...	Dolomite
14b	Salisbury...	8.25	...	72.62	1.48	Chishawasha	Dolomite
16b	Salisbury...	2.70	...	57.86	30.24	Arcturus ...	Dolomite
4501	Salisbury...	...	...	55.82	32.44	Arcturus ...	Dolomite
19b	Salisbury...	61.52	...	19.41	...	Arcturus ...	Dolomite
296a	Mazoe ...	...	...	61.25	26.64	Arcturus ...	Dolomite
296b	Mazoe ...	...	...	71.54	17.00	Arcturus ...	Dolomite
404	Gwelo ...	...	...	52.04	43.17	Arcturus ...	Dolomite
11	Charter ...	...	...	6.08	...	Arcturus ...	Dolomite
12	Melsetter...	...	...	51.82	...	Arcturus ...	Dolomite
588	Gwelo ...	...	...	68.69	...	Arcturus ...	Dolomite

Dolomitic limestone and a lime-bearing rock containing 40 per cent. calcium carbonate and 2-3 per cent. magnesium carbonate have been located on Nyaroro farm, Lomagundi.

**RHODESIAN TRAVERTINE (VLEI-LIME) DEPOSITS CONTAINING IN AIR-DRIED CONDITION
OVER 80 PER CENT. CALCIUM CARBONATE.**

Lab. No.	District.	Silica and refractory silicates.	Iron oxide and alumina.	Calcium carbonate.	Magnesium carbonate.	Water and organic matter.	Locality.
		per cent.	per cent.	per cent.	per cent.	per cent.	
50	Mazoe	1.23	5.08	94.07	4.91	5.20	Umsasa farm
66	Mazoe	1.44	3.53	90.30	2.12	2.93	M'guta farm
16G	Mazoe	2.83	3.30	89.11	3.70	...	M'guta farm
147	Gwelo	0.90	0.46	96.00	1.56	2.00	Safago farm
243	Mazoe	1.26	0.45	94.39	0.83	2.47	Pimento Park farm
337	Wankie	5.40	1.54	90.50	2.52	0.08	152½ mile peg, Bulawayo-Victoria Falls line
56G	Mazoe	0.06	0.58	94.11	2.55	...	Pearson Settlement farm
173	Mazoe	...	0.79	98.76	...	...	Pearson Settlement farm
174	Mazoe	7.29	2.18	88.36	0.48	...	Pearson Settlement farm
1904	Salisbury	3.10	...	91.43	...	4.31	Good Hope farm
37	Mazoe	9.15	...	85.53	1.86	3.87	Portlock farm
30	Salisbury	4.20	...	92.25	1.13	2.19	Selby farm
56	Mazoe	2.96	...	89.96	2.23	4.43	Spitzkop farm
58	Mazoe	4.40	...	92.87	1.84	1.87	Insingesi farm
59	Mazoe	3.23	...	93.63	2.76	2.10	Leopards' Vlei farm
65	Mazoe	6.37	...	86.96	3.94	2.23	Southmore farm
67	Mazoe	2.62	...	89.96	4.91	2.75	Lowdale farm
296c	Mazoe	...	...	94.92	1.51	...	Dillon farm, Shamva
348	Mazoe	...	...	93.75	1.97	...	Dillon farm, Shamva
1005	Hartley	...	...	95.91	2.31	...	Chigwell farm, Hartley
4533	Mazoe	...	...	92.14	3.05	...	Lowdale farm
1283	Mazoe	...	...	90.57	2.53	...	B.S.A. Co.'s citrus estate
1950	Gwelo	...	...	87.14	3.02	...	Safago farm
2703	Gwelo	...	...	86.85	3.26	...	Safago farm
3234	Mazoe	...	...	92.78	...	...	Pearson Settlement farm
2454	Melsetter	...	...	95.01	...	...	Moosgwe farm
2793	Mazoe	...	...	95.35	...	...	M'guta farm

Travertines containing over 80 per cent. calcium carbonate have also been received at the Agricultural Laboratory from Glenhece farm, Lomagundi; Yarrowdale farm, Mazoe, and the Gwaai Reserve.

RHODESIAN TRAVERTINE (VLELLIME) DEPOSITS CONTAINING IN AIR-DRIED CONDITION
LESS THAN 80 PER CENT. CALCIUM CARBONATE.

Lab. No.	District.	Silica and refractory silicates.	Ferric oxide and alumina.	Calcium carbonate.	Magnesium carbonate.	Water and organic matter.	Locality.	Remarks.
270	Wankie ...	per cent. 26.93	per cent. 2.79	per cent. 63.53	per cent. 1.99	per cent. 4.26	152½-mile peg, Bulawayo-Victoria Falls line	
54G	Mazoe ...	18.37	7.73	68.55	1.34	...	Ceres farm, Shamva	
89G	Mazoe ...	10.47	4.85	79.88	2.30	...	Kings' on farm	
328	Wankie ...	19.84	...	72.97	3.72	3.23	Malindi	
1185	Hartley ...	46.08		40.67	11.66	...	Kujawy farm	... Dolomitic
2462	Makoni ...	...	...	21.29	...	...	Kirkly Vale farm, Rusape	
2900	Bulawayo .	...	...	71.77	...	...	Naseby farm	
587G	Makoni ...	...	...	29.64	17.47	..	Raheen farm, Umtali	... Dolomitic

Travertines of poor quality have been located at Shangani and at Crediton farm, Plumtree.
Dolomitic travertines have been located at Oringleford, Makwiro Source, Arimore and Jenkinstown farms, Hartley district, and also in the Victoria district.

For the information of readers who have not studied the relationship between calcium carbonate (lime carbonate), slaked lime and quicklime, the following brief account is given: Calcium carbonate, the form in which lime is present in limestones and travertines, when calcined at a red heat decomposes into carbonic acid gas and calcium oxide, the former being expelled, and the latter, which is known commonly as "lime," "caustic lime" or "quicklime," remaining as a white residue when pure. One hundred parts by weight of calcium carbonate will yield 56 parts by weight of quicklime. Quicklime will chemically combine with water to form a fine dry powder, calcium hydrate or slaked lime, 56 parts by weight of quicklime taking up 18 parts by weight of water to form 74 parts by weight of slaked lime. From these particulars it will be observed that 56 lbs. of quicklime contain the same amount of lime (calcium oxide) as 74 lbs. of slaked lime or 100 lbs. of lime carbonate (calcium carbonate).

The rapid slaking of quicklime, which arises from the direct addition of water, being accompanied by the development of considerable heat, a certain amount of water is converted to steam during the slaking process, consequently a little more than the theoretical quantity of water must be added to slake quicklime completely. Slaking also takes place on exposure of quicklime to moist air, but the development of heat during the process is not so noticeable owing to the chemical combination of the water and quicklime taking place more slowly. If slaked lime, produced from quicklime either by the direct addition of water or by the absorption of moisture from the air, is allowed to remain exposed to moist air, a further change slowly takes place, carbonic acid gas being absorbed to form calcium carbonate. Thus, on exposure to moist air, quicklime ultimately reverts to calcium carbonate, the form of lime from which it was produced by calcination. "Burnt" lime which has been allowed to undergo this reversion is often called "spent lime." The advantage to be derived from the use of freshly burnt lime, where quicklime or slaked lime is required, must therefore be evident.

The chief uses of lime are for building, in chemical manufacture, the extraction of gold by the cyanide process and in agriculture. The raw materials used for preparing quicklime or slaked lime may be nearly pure calcium carbonate, such as marble or calcite, or they may be impure limestones or lime travertines. For chemical use or gold extraction by the cyanide process, marble, calcite or the purest forms of limestone burnt out of contact with the fuel are the best, because the value of the product for these purposes solely depends upon the amount of soluble lime which it contains. For the preparation of ordinary building lime, impure limestones or lime travertines burnt in contact with the fuel and containing sufficient calcium carbonate to produce, on burning, a good caustic lime are the most suitable raw materials. A very rich lime such as that produced by burning calcite out of contact with the fuel is not only more expensive than a less pure lime obtained by burning limestone in contact with the fuel, but is also too rich for building purposes unless mixed with burnt clayey material. Very good limestones, or travertines for the production of lime for building, gold extraction or agricultural purposes contain

90 to 95 per cent. calcium carbonate, but any raw material containing over 80 per cent. calcium carbonate and less than 5 per cent. magnesium carbonate will yield lime of very satisfactory quality for these purposes. Dolomites and limestones or travertines containing much magnesium carbonate are not used for the manufacture of lime, except for a few special purposes such as the lining of the converters used in the basic method of steel manufacture, because lime produced from such raw material slakes very imperfectly.

Whilst calcite is not usually classed as a limestone geologically, it has been so classified in this article for convenience, and from information supplied by Mr. J. Meikle, of Umtali, it is interesting to record the occurrence of very large bodies of calcite near the Sabi River 20 to 27 miles west of Odzi Station, the largest body being over three miles long by about 200 yards wide, and rising above the surrounding country to an elevation of 400 feet. Calcite can, however, only be treated by thorough grinding and then burning out of contact with the fuel; if burnt in the ordinary type of lime kiln, it splits into fine dust.

Limes containing from 15 to 30 per cent. of clayey matter are called hydraulic limes because they have the property of setting very firmly under water. Although none of the samples referred to in this article has been examined specially for hydraulic properties, it is probable that some of the rocks from which they were obtained will, on burning, yield limes possessing such characteristics to a marked degree; for example, that represented by sample No. 272 obtained at 1552½-mile peg on the Bulawayo-Victoria Falls line is worthy of investigation in that connection.

St. O'Gorman Scientific Cattle Dip.

The successful tenderers for the supply of cattle dip are the above company. St. O'Gorman Chemical Company, Ltd., now have the whole of the Government contracts for a year. The arsenic used by the company in the manufacture of their dip is procured from the Gwanda arsenic mines, where a modern plant has recently been erected for the recovery of arsenic.

Recent samples taken from bulk parcels return the extremely high percentage of 99.9 (A.S.2, O.3). St. O'Gorman Cattle Dip is now supplied only in new five-gallon iron drums that are both electrically and oxy-acetylene welded.

Poultry Husbandry.

MATING FOR IMPROVEMENT AND INCREASED EGG PRODUCTION.

By A. LITTLE, Poultry Expert.

The right period for mating up the breeding pens in Rhodesia is during February, preferably at the commencement of the month. Every poultry keeper's aim should be to have chicks out as early in April as possible, for the earliest chicks always make the best birds and best layers, while they produce eggs when the old birds are moulting. Were it possible to do so, the writer would like to mate up every pen in the country, and feels sure that a rapid improvement in the poultry stock of Rhodesia would result. It is, however, not possible, and this article is written with the object of assisting all those who cannot be given personal advice.

On the right selection and mating for future stock entirely depends the success of the individual poultry keeper. Every bird, no matter whether it is pure bred, first cross or a mongrel, has certain points, anatomical or otherwise, by which it can be put in the category of a good layer, a medium layer or a bad layer. The same applies to the male bird as a breeder of layers. Further, certain points are to be noted in each by which it is possible to tell whether it has the all-important qualities of health, strength, vigour and stamina; no bird that has not these qualities well developed should be bred from. A bird, no matter how well fed, housed and cared for, will not lay well unless the laying points are well developed, nor will the progeny do so; on the other hand, a bird with good laying points will not produce eggs in large numbers unless she is well fed, properly housed and cared for.

The first and most important point in choosing the breeders is health and vigour and stamina; unless these are present in the breeding stock, poor hatches, weak chicks difficult to rear and future weak, poor laying stock will be the result. The selection must, therefore, be first made with these points in view. After the strongest, healthiest and most vigorous have been selected and placed on one side, selection from these must be made according to laying points. Even if there are one hundred birds to select from and only ten show good laying points, use these and these only for breeding from rather

than add ten more that are not so good. It is far more profitable to do so; further, there will be much more rapid improvement in the stock with less labour and no greater expense.

The male bird plays the most important part in the production of good layers, for it is chiefly through him that the laying qualities are transmitted from his mother to his progeny. Therefore, a cockerel should be chosen to head the breeding pen from the best layer of large eggs, for he is the chief factor in transmitting size of egg to the progeny. The following points too should be noticeable in the male bird: Viciousness, good fighting qualities, a clear full crow and one that shows masculinity to a marked degree. The hens chosen should be those that are off the roost early and which return to it late; those that are active and alert-looking, that are continually scratching and foraging for their food, that are deep in body from the back downwards, that are broad, full and deep in the breast, that stand firm and upright with legs set well apart and have short shanks with little of the thighs showing. On the other hand, none should be chosen which are dull and listless, that hang about the house and run waiting to be fed, that have narrow, cut-up breasts, long legs inclined to be knock-kneed, that lack depth of body and development behind the legs. The tail too in good layers and breeders of layers is always carried high. Having chosen the birds, the next procedure is to handle each one, noting carefully its points and anatomy; to do this, commence with the

Head, which should be small to medium in size, short from the end of the beak to the eye, fairly broad and deep and round on the top, the face as smooth as possible and quite red and healthy looking.

The beak must be short, broad at its base and well arched; inclined to the shape of a parrot's. The top of the head and beak should form a double curve; these points denote strength, vigour, stamina and good laying; a long, flat, narrow head and beak the reverse.

The eye must be large, round, bright and prominent, free from a drooping lid and heavy, overhanging eyebrow. A dull, sunken, sleepy-looking, almond-shaped eye must be avoided if good, strong, vigorous birds and good layers are to be produced from the breeding pen.

The comb in both sexes should be small to medium in size; heavy, beefy combs are not desirable for the objects in view. In the females the texture of it and the wattles should be fine, smooth and soft like kid, whereas in the cocks a little roughness, but not coarseness, is necessary. Both comb and wattles in both sexes should be of a bright, cherry-red colour.

The breast as noted above should be full, deep and broad; this is very necessary to give full expansion to the lungs, which enables the bird to inhale the maximum of fresh air (oxygen), and so ensure health and vigour. A narrow, cut-up breast lacking depth means poor layers and weak chicks.

The back should be long and as broad as possible, especially across the part where the wings are attached to the body; the following measurements will act as a guide:---

	Heavy Breed.	Light Breed.
	Male.	Male.
Very good	8 inches	6½ inches
Good	6 inches	5 inches
Poor	4½ inches	3½ inches
	Female.	Female.
Very good	6 inches	5 inches
Good	5 inches	4½ inches
Poor	4 inches	3 inches

The back, too, must be flat; a narrow, rounded back or one sloping on each side from the back bone, leaving a ridge which can be felt when the outstretched hand is placed on it, denotes lack of vigour and stamina, and no bird with this fault should be bred from.

The abdomen, i.e., the part under the tail and behind the legs, should, especially in the female, be wide, deep and full. Under this section we deal with one of the most important points, viz., the distance between the end of the breast bone and either of the pelvic bones in the female, and in the male between the latter. Although this is the most important point to be considered in choosing breeding stock to produce good layers, it must on no account be taken that it is the only one, as many seem to imagine. In selecting birds for the purpose in view, all points enumerated in this article must be taken into consideration in conjunction with this of the pelvic measurements. The ends of the pelvic bones are found just under and on each side of the "parson's nose," i.e., the root of the tail; the end of the breast bone is lower down and half way between the pelvic bones, the three forming a triangle, with the end of the breast bone as the apex.

The following measurements for width between the pelvic bones in the female will be a guide:—

Very good	2½ inches.
Good	1½ inches.
Poor	¾ inch.

Sometimes birds will measure more than two-and-a-half inches; these are exceptionally good. Those measuring only one-and-a-half inches should be kept to produce eggs for eating only and not be bred from. Those measuring only three-quarters of an inch or under are not worth keeping at all and should be killed. It is well to remember that when a bird is not laying for some reason or other, as, for instance, when she is moulting, is ill, etc., the pelvic bones are closer, and this must be allowed for. The quality of the bones, too, is a point; for instance, if they are thin, straight and pliable, the bird possessing such is better than a bird with thick, rigid, curved ones. The distance between the end of the breast bone and one or other of the pelvic bones, too, is important, both in the male and female, as follows:—

	Male.	Female.
Very good	2 inches	4 inches
Good	1 inch	2½ inches
Poor	½ inch	1 inch

Such should be the procedure of every keeper of poultry whether he or she possesses 12 birds or 1,000 during the few weeks preceding the commencement of the breeding season. It is only by this procedure that an improvement in stock and egg production can possibly be accomplished. Too many people are content to go on each year breeding from all and sundry, good, bad and indifferent; they will never be successful with their poultry. If, however, the above instructions are followed each year, the poultry keeper will have *only* strong, vigorous, healthy and profitable birds.

Malting Barley.

It will be recalled that a little over a year ago a representative of the South African Breweries toured certain parts of this Territory with a view to inducing wheat farmers to grow malting barley under the same conditions as wheat has hitherto been grown, viz., as a winter crop under irrigation or on wet vleis. The inducements offered were the supply of seed at a low price and a guarantee to buy the resulting crop at a reasonable figure. It was also pointed out that barley would provide a good rotation with wheat for these particular soils. Advantage was taken of this offer by a number of farmers, and all the crops harvested during October and November last offered to the Brewery have been bought at a uniform and satisfactory price, and many farmers have expressed themselves keen to take up the growing of this crop on similar lines in future seasons.

The Chief Brewer at Salisbury has issued a report on the grain received by him this season, and, as his remarks are of great interest and concern the farmer closely, a summary is given herewith.

"On the whole the barley grown in Rhodesia is a very fair sample of the requirements for the malting floor, and the defects noted are due either to the seed supplied or to the inexperience of the farmers in producing a crop for this particular purpose. These defects are. (1) Irregularity in size and shape of grain, which will result in uneven germination, due to the fact that the seed supplied in the first place by the Brewery must have lacked uniformity of type; (2) pooriness of colour, due to harvesting too early or too late, or again to the grain getting wet and heated after harvesting; (3) grain damaged through wrong threshing methods. In threshing barley the teeth of the thresher should be set further apart than for wheat in order to prevent the breaking of the awns too close to the grain; (4) the presence of impurities such as wheat and rye, due probably to impurities in the seed, to volunteers of the previous crop appearing in the barley, or to lack of care in sowing."

The report on the best crop received and grown in the Salisbury district by Mr. C. C. Townsend is deserving of being quoted in full: "This is the best sample received to date, the colour being very fine. A few broken grains, otherwise the sample is plump and well matured. The yield obtained was at the rate of $6\frac{1}{2}$ bags per acre."

It is obvious that the defects referred to above can be remedied by careful attention and that no disadvantage of climate forms an insuperable obstacle to the production of a saleable article which can be placed on the market. To warrant their establishing maltings in Salisbury the South African Breweries require a reliable supply of barley, and, if this is forthcoming, our wheat farmers will have available an alternative and payable crop which will greatly help to stabilise their operations.

Queries regarding the cultural methods employed in the handling of this crop, which was new to the majority of farmers, elicited the following facts:—

In the majority of cases the crop was grown on wet vlei soil, and in some instances the barley was the first crop grown, the land being virgin and ploughed up for the first time. Seed was usually broadcasted at rates varying from 40 to 65 lbs. per acre. When the seed was drilled, the amount of seed used per acre fell to 35 lbs. In almost every case manure in some form or other was applied. One report states that a dressing of ash gave good results, while another states that artificial fertiliser had no obviously beneficial effect on the crop. In no case did the land receive a heavy dressing of manure. Yields varied greatly with varying conditions. The lowest recorded yield was one of two bags per acre. Under irrigation yields of 12 bags per acre and even more were secured, with an average of 5 to 6 bags for wet vlei land. The amount of seed retained for sowing in 1922 was in some cases very considerable, showing that a further serious attempt to grow this crop in the light of the experience gained would be made this coming season.

Other remarks made include the following:—

"I can say that barley is a crop well worth further trial. My present crop, though not a success, encourages me to give it another trial."—(Beatrice district.)

"Part of crop eaten down when 4 ins. high; came on again, but was not half as good as the other."—(Makoni.)

"A reaper and binder costing £90 would be a great boon."—(Charter.)

"Owing to being unable to harvest until 14th October, the barley crop is stained and discoloured and hardly fit for malting purposes."—(Marandellas.)

"The grain harvested is better than that sown."—(Marandellas.)

"The results are encouraging. . . . Better results will be obtained as my lands get sweeter."—(Marandellas.)

"Rain fell before harvesting and the grain became discoloured."—(Salisbury.)

J. A. T. W.

A New Zealand Fruit Farm.

[The following notes were written by Miss E. C. Steedman, who until recently was farming in the vicinity of Guelo.—Ed.]

An account of a fruit farm in the beautiful Wairarapa Valley in the south-east of North Island, New Zealand, may be interesting to Rhodesians. In the poetic Maori tongue the farm was known as "Makuratanga," "the place of many trees," and was just outside the prosperous township of Greytown, named after Sir George Grey, at one time the far-seeing and much-beloved Governor of Cape Colony, and after whom the Grey College, Bloemfontein, is named.

Getting out at the station one might be in an English country town, except for the wooden houses and the greater luxuriance of flowers and foliage. English trees, the poplar, oak, lime, sycamore, elm, chestnut, Scotch firs, larches, etc., prevail, and the gardens are gay with lilac, laburnum, syringa, wistaria and roses encircling well-kept lawns. Driving up to Makuratanga, what a sight met the eye! Twenty acres of cherries in full bloom, "Loveliest of trees, the cherry now is all in white along the bough." The farm comprises 140 acres of rich alluvial ground in a river flat, many feet deep, formerly covered with forest. When cleared, the land is ploughed and sown with English grasses, hence the prevalence of common English weeds. On this farm, turnips, rape, oats and clover were mainly grown for food for the horses and cows and good clover hay sold, rotation of crops being observed. This was, however, subsidiary to the orchards.

Cherry Orchards.—There were 6,000 cherries in full bearing on 20 acres of ground, the owner, Mr. Tate, being the largest and most successful cherry-grower in New Zealand. The trees are all grafted, procured from Australia, and cost 2s. 6d. per tree. They bear at eight years old and were set at 20 ft. apart, not nearly far enough, and Mr. Tate was contemplating cutting out every other tree, as he said they should be 40 ft. apart in such rich soil. They are pruned up to five years, leaving five principal branches, the shoots being shortened. When first planted the ground is treated with superphosphate and bone dust, 400 cwt. to the acre; this is renewed every third year, and the ground is well limed every three years, 2 tons to the acre. The ground is kept freed from weeds by continual cultivation. The orchardist can never rest; continual spraying is the only way to ensure good fruit. A new disease, which affects all stone fruit, has been introduced from America during the past four years known as brown rot, a fungoid disease. To destroy this a lime sulphur solution is used, sold in 42-gallon casks at 1s. 3d. per gallon. For

his orchards Mr. Tate uses 25 casks per season—1,050 gallons. Four-and-a-half gallons are mixed with 100 gallons of water for spraying "in the pink"—just as the buds are bursting. When the blossom falls, the strength used is one gallon to 100 gallons of water. After the fruit is set it is sprayed every ten days until beginning to ripen. In January the trees are sprayed with arsenate of lead, $3\frac{1}{2}$ lbs. to 100 of water, to destroy insect life.

The cherry season lasts from November to Christmas. Women and girls are engaged to pick and sort. The fruit is packed in 10 lb. boxes lined with paper and sent the same day by train, mainly to the Wellington market, where they are sold by auction, averaging about 1s. per lb.

During the ripening season all kinds of devices have to be resorted to to scare the birds away. Mr. Tate has six shot guns and thousands of cartridges with which he arms his men; thousands of Chinese crackers set on wheels, which go off at intervals, also old tanks and drums are placed round the orchard, and a boy continually goes round with an iron bar striking them. During the nesting season 3d. per dozen is given for blackbirds' and thrushes' eggs! Notwithstanding all this, the birds hold their own, and Mr. Tate thinks the only way is to enclose the whole orchard in a wire netting cage, which would cost about £1,700.

Apple Orchard.—There were 6,000 trees on 30 acres, comprising Sturmer, Delicious and Jonathan. Grafted trees are bought and set 20 ft. apart in well ploughed ground. They bear at five years old and are pruned every year to get regular crops, being kept small and open for spraying. At every stage the tree appears to be attacked by some kind of disease, viz., black spot, mildew, sucking insects, codling moth, red spider, scale, woolly aphis or American blight, fire blight, etc. To combat these the trees are sprayed (1) in the winter with red oil to kill insect life, the strength being 1 gallon of oil in 15 of water. Red oil costs 5s. 6d. per gallon. (2) In the pink with lime sulphur solution, $4\frac{1}{2}$ gallons to 100 of water. (3) When petals falling with solution containing $1\frac{1}{2}$ gallons lime sulphur, $3\frac{1}{2}$ lbs. arsenate of lead and $3\frac{1}{2}$ lbs. lime in 100 of water, the lime being used to counteract the acidity of the arsenate of lead. This is to kill the codling moth and black spot. (4) Every fortnight for the next two months with above mixture, the lime sulphur being reduced to one gallon. (5) In February with the same mixture for leaf rotter and late black spot on the apple.

The spray is put on with power pumps working at 250 lbs. pressure and capable of spraying 3,000 gallons per day with two machines.

Packing.—The picking season begins in April. Here 30 men were employed in picking, sorting and packing for a month. First grades are wrapped in paper and put in 40-lb. cases, lined top and bottom with wood wool, and sent to cool storage. Seconds were sent to the local market and all wastrels used for pigs. The average price for firsts would be 7s. 6d. per case, of which the producer would only get about half, the cost of freight and cold storage being so high.

Other Fruit.—In addition to the above there were 1,000 pear trees of the varieties Winter Cole, Barry and Napoleon, treated like the apples, and plums, the cherry plum trees being laden with fruit.

My host was not enthusiastic about fruit growing. It appears to be a pure gamble; so much depends on the weather and the market, while constant vigilance is needed to combat the various pests. The orchards were protected against wind with rows of well grown poplar trees. There must, however, be something in apple-growing, as round Nelson many new apple orchards are being planted. The price locally seems high: 6d. per lb. from September onwards, and never less than 3d. for good varieties. The price of land appears staggering to a Rhodesian, from £50 to £200 per acre being paid for developed farms in the Wairarapa.

Notes on the Maize Stalk Borer or "Top Worm."

By RUPERT W. JACK, F.E.S., Chief Entomologist.

The present time, when the maize farmer is able to contemplate his crop in full growth (as far as weather conditions permit), is seasonable for emphasising some facts concerning the Stalk Borer, to which the writer has more than once called attention in the past.

The pest is particularly prevalent this season; last season it was unusually innocuous. In what way is this to be explained? Increase and decrease of insect pests are influenced by a variety of obscure factors which are not thoroughly understood, and a complete explanation of the abundance of this particular insect during the present season will not be attempted. None the less, certain patent factors are discernible. Last season the rains were very late, and planting in general was postponed until December; this season planting took place even round Salisbury from the middle of November onwards. Observations extending now over some thirteen seasons have confirmed the writer in the opinion that early planting in this Territory is dangerous. Crops planted from 16th November onwards are available for inspection round Salisbury, and the earliest planted crops are the only ones in which borer attack has been overwhelming. A higher percentage than usual of bored plants occurs in crops planted up to the first week in December,

but those planted towards the middle of the month are practically free except for migrant borers from volunteer plants which, of course, came up much earlier.

There is a general opinion that the earliest planted maize produces the best yield, but this is very questionable, even apart from the influence of borer. It depends very largely upon the season. Crops were, on the whole, very good last season in spite of the late planting. The writer in fact regards what the maize farmer would, as a rule, describe as an unusually good planting season, that is to say, abundant early rains, as something in the nature of a pitfall for the unwary. The dates given in an article on the Maize Borer published in the *Rhodesia Agricultural Journal* for December, 1917, as a result of five years' experiments at Salisbury, have been confirmed by subsequent observations. Crops planted before 27th November are liable to severe attack, and the greatest degree of safety is secured by planting after 4th December. If neighbours have maize lands lying near each other, the one who plants first is liable to attract by far the greater proportion of borer.

The reason for this is that the parent moths prefer to lay their eggs on the more forward plants at the beginning of the season. The second brood of moths, which emerges about the end of February, on the other hand, prefers to lay in the more backward plants because the bulk of the maize is in process of becoming a little hard by this time. Consequently crops planted after the New Year, of which the plants will still be rather small towards the end of February, are liable to suffer severely, especially if the first brood has been a large one, owing to early planted maize being in the vicinity.

The golden rule, as far as Salisbury and the neighbourhood are concerned, is therefore to plant between 4th December and Christmas. Some lower altitudes may be rather earlier, but the writer is not yet convinced of this.

Mention is made above of the effect of migration of borers from volunteer maize. The parent moth may lay over sixty eggs in a clump, and more than one moth is likely to lay on one plant when maize plants are not very abundant in the neighbourhood. The plant is unable to support all these borers, and they consequently migrate and will infest other plants near by. Volunteer plants should therefore be removed and destroyed early. Where labour is available it is also a good plan to cut out and remove all infested plants as soon as noted, in this way restricting the damage to the original infests. One infested plant may be the cause of infestation of a dozen or more others in its vicinity.

As a trap crop, the early planting of a number of rows of maize or kaffir corn is to be recommended. These can be planted as early as conditions permit, and must be removed and destroyed before the main crop is up. Finally, kaffir corn is more attractive to borer than maize, and a few rows may be planted here and there through the field at the time of planting the maize, with a view to attracting the moths of the second brood. They should be removed and destroyed about the middle of March.

Molasses Grass.

The following report on molasses grass received from Mr. F. W. A. Taylor, Kilmer Farm, Glendale, Mazoe, will be read with interest:—
“I have two small patches of molasses grass here, one planted from seed, January, 1920, the other January, 1921. The first had a good growth on it this year, 2 ft. to 2 ft. 6 ins. high and very thick, and I was able to collect a fair amount of seed from it—about one cement bag full of actual seed, not seed heads, which I think has not been injured by frost. After I had cut off the heads, and well into September, there was always a certain amount of green growth near the ground, where it was protected from the frost by the old growth, which had been left standing about 2 ft. high.

“One night in October, when there was scarcely a blade of green grass on the farm, about sixty head of oxen found the patch of tall dry molasses and remained feeding on it for hours. It is about half an acre in extent, and they did not appear to move much, standing still and feeding, with the herd boy simply sitting down meanwhile. From this I assume that cattle must relish molasses grass even when dried out by drought and frost. I have also noticed the same with a horse.

“After collecting seed once from a small patch on my plot at Mount Pleasant I had the dry grass cut by hand and fed to my horse, and he ate it as readily as any dry feed I had ever given him.

“The seed I planted here last January has not had a fair chance owing to the light rainfall, but since this season's rains have broken it is making more progress. Before the rains began it was coming on better than the veld grass, but it has not responded to the first rains nearly as well as the ordinary veld has since done.

“Molasses grass has not done as well here as on my plot near Salisbury, and even there the growth was not as good the fourth year as it was in the second and third years. I therefore doubt its permanence as a pasture.

“The grass is indigenous to Rhodesia, and I have seen it on granite kopjes around Rusape, but nowhere else, and then only on kopjes; never on the flat.”

RHODESIAN MILK RECORDS.—RETURN FOR FIRST 28 DAYS.

Name of cow.	Breed	Commenced record.	Milk in lbs.	Per cent. butter fat.	Butter fat in lbs.	Total milk to date in lbs.	Total butter fat to date in lbs.	Name and address of owner.
Granny	Friesland	9/10/21	567	3.8	21.54	567	21.54	J. S. Struthers, Palm Tree, Sinoia.
Rosebud	do	do	672	4.2	28.22	672	28.22	do do
Maureen	do	do	875	2.7	23.62	875	23.62	do do
Cherry Blossom	do	16/10/21	633	4.8	30.38	633	30.38	do do
Bell	do	20/11/21	1,417	3.0	42.51	1,417	42.51	do do
Panami	do	1/9/21	472	...	...	472	...	G. W. Davis, N'Gombe, Sinoia.
Seponka	do	do	430	...	...	430	...	do do
Chumboko	do	do	336	...	...	336	...	do do
Quetta	do	do	570	...	...	570	...	do do
Gandwan	do	do	339	...	...	339	...	do do
Daisy	Shorthorn	2/11/21	447.3	3.75	16.77	447.3	16.77	C. G. T. Cooper, Essexvale.
Dolly	do	do	245.5	4.11	10.21	245.5	4.11	do do
Zaza	do	do	304.5	3.93	11.97	304.5	11.97	do do
Kalela	do	do	263.9	3.91	11.32	263.9	11.32	do do
Kupinia	do	do	253.4	3.80	9.63	253.4	9.63	do do
Mata	do	do	399.0	3.69	14.76	399.0	14.76	do do
Banjo	do	do	289.3	3.54	10.24	289.3	10.24	do do
Maggie	do	30/11/21	336.7	3.85	12.96	336.7	12.96	do do
N'Gonga	do	do	375.2	3.64	13.66	375.2	13.66	do do
Rose	Red Poll	17/10/21	710.5	3.70	26.38	710.5	26.38	W. R. Waller, Bluff Hill, Salisbury.
Alice	do	18/10/21	785.5	3.90	30.63	785.5	30.63	do do
Pepi	do	11/10/21	616.0	3.50	21.56	616.0	21.56	do do
Histonhurst Titania	Shorthorn	12/12/21	493.0	...	...	493.0	...	Mrs Claude Radcliffe, Histonhurst, Victoria
H. Oretonne	do	do	462.0	...	...	462.0	...	do do
H. Beatrix	do	do	409.5	...	...	409.5	...	do do
H. Charner	do	do	332.5	...	...	332.5	...	do do
Moreen	do	3/12/21	633.0	...	...	633.0	...	do do
Doreen	Friesland	do	708.5	...	...	708.5	...	F. E. Pickering, Fairview, Sinoia.
Peach	do	do	525.0	...	...	525.0	...	do do
Umcola	do	do	595.0	...	...	595.0	...	do do
Cherry	do	10/12/21	505.0	...	...	505.0	...	do do

* These cows are suckling their calves.

RETURN FOR SECOND 28 DAYS.

Name of cow.	Breed.	Commenced record.	Milk in lbs.	Per cent butter fat.	Butter fat in lbs.	Total milk to date in lbs.	Total butter fat to date in lbs.	Name and address of owner.
Panami	Friesland	1/9/21	686	...	...	1,138	...	G. W. Davis, N'Gombe, Sinoia.
Seponka	do	do	605	...	...	1,077	...	do do
Chunaboket	do	do	591	...	...	927	...	do do
Quetti	do	do	920	...	...	1,490	...	do do
Gardwant	do	do	346	...	...	885	...	do do
Daisy	Shorthorn	2/11/21	406.7	3.87	15.74	854	32.51	C. G. T. Cooper, Chambracy, Essexvale.
Kalela...	do	do	259.7	5.24	13.61	523.6	24.93	do do
Mata	do	do	352.8	3.26	11.5	751.8	26.26	do do
Zaza	do	do	305.5	3.93	11.14	576.1	23.01	do do
Rose	Red Poll	17/10/21	654.5	3.5	22.90	1,365	49.28	do do
Granny	Friesland	9/10/21	632	4.2	26.54	1,199	48.08	W. R. Waller, Bluff Hill, Salisbury.
Rosebud	do	do	692	4.5	31.14	1,364	59.36	J. S. Struthers, Palm Tree, Sinoia.
Maureen	do	do	1,053	4.2	44.22	1,928	67.94	do do
Cherry Blossom	do	16/10/21	716	5.0	35.80	1,349	66.18	do do
Bell	do	20/11/21	1,372	3.8	52.14	2,789	94.65	do do

† These cows are heavy in calf.

Agricultural Outlook.

Very considerable anxiety is being felt at the time of writing (23rd January) at the exceptional spell of dry weather, which is seriously affecting the maize and tobacco crops. Up to the end of December the rainfall over the greater part of the Territory was above normal, and conditions generally were extremely favourable. Since then the almost total absence of rain and the extreme fierceness of the sun's rays have had a damaging effect, and at the best reduced harvests must be expected. In the case of maize, the plant is better able to resist the absence of moisture now than it would have been a month ago, while the dry period has afforded an opportunity for thorough cultivation, thus helping to conserve such rain as has already fallen. Everything, however, depends on the weather conditions during the ensuing week. If good rains fall and continue well into the season the maize crop should recover, and the yield may not be very considerably below normal. The same remarks apply in the case of side crops. The tobacco which was planted at the end of December and the first week of January has suffered severely, and only a poor stand can be expected from this portion of the crop. The early planted tobacco has in many cases flowered prematurely, and unless unusually favourable conditions prevail for the remainder of the season, both the yield and quality of the leaf will be seriously impaired. In any case the total crop is likely to be considerably less than was expected.

Many farmers have taken advantage of the dry spell to make hay, and where this has been done the quality should be excellent. Despite the employment of fire patrols in conjunction with the Police and the Native Department, there have been since Christmas an exceptional number of grass fires in the Matobo, Bulawayo and Bulalima-Mangwe districts. Grass fires at this time of the year cause more damage than if they occurred before the commencement of the rains, and it is to be feared that the grazing in the areas mentioned will be sparse during the winter season.

A writer in a recent issue of the *Rhodesia Herald* made a suggestion that the Agricultural Department should publish a notice in the local Press calling attention to the time when any particular insect pest is to be met with and the precautions that should be taken to meet its depredations. We would draw attention to the entomological section of the Farming Calendar published as a regular feature of this *Journal*, where information of this nature is given. Crop pests, especially cut-worms, have been particularly prevalent this season, and considerable damage is reported from various districts. Most of the insect pests with which farmers have to contend have been the subject of articles in this *Journal*, and bulletin reprints of most of them can be obtained from this office.

Cattle are reported to be in excellent condition, and the rate of increase is satisfactory. The Deweras Ranching Co., Shagari, record an increase of 87 per cent. This company has adopted a system of regular calving over a period of three months, and everything points to its being a success. The bulls are introduced into the herds about the first week in December, and calving is over by Christmas. Prices for cattle rule very low, and are likely to remain so until an outlet is found for our surplus stock. The re-opening of the Odzi canning factory would assist, and it is to be hoped that the efforts now being made towards this end will be successful.

There is a shortage of native labour in some districts, but for the most part the supply is adequate. Wild dogs are reported to be very numerous in the Melsetter district, and a number of farmers have lost stock as a result of visits of these pests.

The Second Southern Rhodesia Egg-Laying Test.

REPORT ON THE TENTH PERIOD
(9th December, 1921, to 5th January, 1922).

Ninety-two birds were laying during the four weeks and produced 1,454 eggs, an average per bird of 15.85 eggs, or, for the 99 now on the test, an average of 14.68 eggs per bird, which, considering a number have been broody and that a number are moulting (some of these are laying), is a fair average. The total weight of eggs for the four weeks was 194 lbs. 12 8-16 ozs. (171 lbs. 15 6-16 ozs. of eggs 2 ozs. and over, and 22 lbs. 13 2-16 ozs. of eggs under 2 ozs.).

The maximum number of eggs laid on one day was 60 on each of the two days 16th December and 27th December, and the minimum 46 on 26th December. The average number per day was 51.92.

Pen 13 laid 99 eggs in the four weeks.
Pen 16 laid 96 eggs in the four weeks.
Pen 9 laid 93 eggs in the four weeks.
Pen 11 laid 90 eggs in the four weeks.
Pen 15 laid 89 eggs in the four weeks.
Pens 17 and 19 each laid 87 eggs in the four weeks.
Pen 12 laid 80 eggs in the four weeks.

Of the trap-nested birds the following laid---

24 eggs—Nos. 55, pen 11, and 83, pen 17.
23 eggs—Nos. 35, pen 7, and 65, pen 13.
22 eggs—Nos. 42, pen 9; 53 and 54, pen 11; 57, pen 12, and 75, pen 15.
21 eggs—Nos. 45, pen 9; 61, pen 13, and 81, pen 17.
20 eggs—Nos. 36 and 37, pen 8; 41, pen 9; 58 and 60, pen 12; 62 and 64, pen 13, and 73, pen 15.

Eleven birds have been broody, two of them twice during the four weeks. The period of continuous non-laying days of these birds has ranged from five to twenty days; they have all been birds in the heavy breed section.

Thirty-one birds are moulting, but twenty-five of these are laying, the majority well. One bird in pen 6 is still suffering from dropsy, but is laying. One bird in pen 3 is still suffering from swollen legs, face, comb, wattles and joints. A number of birds of the same strain have shown the same symptoms. The disease is an obscure though not infectious one (but peculiar to the strain) and is being investigated.

Hen No. 51, pen 11, died suddenly on 26th December. Post mortem examination showed death was due to rupture of a blood vessel in the oviduct adjacent to a fibrous tumour of this organ. She was a good layer, but stopped on 6th December, laid a 2 5-16 ozs. egg on the 19th and a 2 6-16 ozs. egg on the 22nd; she was in apparently good health and took her food well up to the day of her death. This bird has been replaced.

The output of eggs is less by 32 than last period, which is due partly to moulting and broody birds and in a slight degree to the fact that some are feeling the strain of heavy laying since the commencement of the test. It will be noticed though that the total weight of 2-oz.-and-over eggs is greater and that of those under 2 ozs. is less than last period; there is no doubt this is due to a greater quantity of succulent green food which is now available.

Rain fell on twelve days in the four weeks, viz., the heaviest daily falls were on the 23rd, .57; 26th, .68, and 29th, .79. The total for the four weeks was 4.36 inches.

THE SECOND ANNUAL SOUTHERN RHODESIAN EGG-LAYING TEST.
FIVE BIRDS IN EACH PEN.
HEAVY BREED SECTION.

1ST APRIL, 1921, TO 2ND MARCH, 1922. TENTH PERIOD (40 WEEKS).

Pen No.	Position.	Owner.	Residence.	Breed.	Results from 1st April to 5th January, inclusive.		
					Total No. of eggs.	Under 2 ozs.	Total weight of eggs.
					2 ozs. and over.	2 ozs. and over.	Under 2 ozs.
1	6	R. Coulthard	Salisbury	White Wyandottes	448	351	39 lbs. 4 6-16 ozs.
2	2	Mrs. Brokensha	Umtali	do.	570	18	2 lbs. 1 14-16 ozs.
3	7	Mrs. Pocock	Ardennie	Bd. Plymouth Rocks	343	28	3 lbs. 4 6-16 ozs.
4	1	C. L. Brown	Salisbury	Rhode Island Reds	729	25	2 lbs. 14 14-16 ozs.
5	3	H. Tatham	Penhalonga	White do.	587	81	9 lbs. 7 4-16 ozs.
6	5	A. G. Walker	Salisbury	do.	524	71	8 lbs. 3 9-16 ozs.
7	4	A. T. Wagstaff	Pretoria	Black Orpingtons...	584	109	12 lbs. 12 9-16 ozs.
Totals					3,785	683	78 lbs. 14-16 oz.
LIGHT BREED SECTION.							
8	12	E. O. B. Mee	Bulawayo	White Leghorns	582	252	39 lbs. 2 4-16 ozs.
9	1	C. L. Brown	Salisbury	do.	845	54	6 lbs. 3 9-16 ozs.
10	9	Mrs. Redrup	Bulawayo	Black Leghorns	634	88	10 lbs. 6 3-16 ozs.
11	3	T. W. Brokensha...	Umtali	White Leghorns	803	195	21 lbs. 2 5-16 ozs.
12	4	B. S. Edgecumbe...	do.	do.	805	99	11 lbs. 10 2-16 ozs.
13	2	Weymouth Py. Farm	Bulawayo	do.	829	137	16 lbs. 12 10-16 ozs.
14	11	Yorkshire Py. Farm	do.	Anconas	599	112	13 lbs. 7 15-16 ozs.
15	8	Miss Greig...	do.	White Leghorns	652	120	14 lbs. 8-16 oz.
16	5	E. C. Holmes	Bindura	do.	797	165	19 lbs. 5 14-16 ozs.
17	13	Avondale Py. Farm	Avondale	do.	385	399	45 lbs. 13 ozs.
18	10	Mrs. Redrup	Bulawayo	Anconas	635	64	7 lbs. 8 3-16 ozs.
19	6	Mrs. Mulligan	Lobatsi	White Leghorns	706	56	6 lbs. 8 14-16 ozs.
20	7	Mrs. Hunter	P.B. Glendale	do.	697	20	2 lbs. 6 1-16 ozs.
Totals					8,969	1,761	213 lbs. 13 8-16 ozs.
Grand totals of both sections					12,754	2,444	291 lbs. 14 6-16 ozs.

Total number of eggs for 40 weeks (10 periods), 15,198; total weight, 1,972 lbs. 10-16 oz.
There are 99 birds now on the Test. Positions are calculated on total weight of 2 oz. and over eggs.

Southern Rhodesia Veterinary Report.

October, 1921.

AFRICAN COAST FEVER.

No cases occurred during the month.

QUARTER-EVIL.

The following mortality was reported:—Bulalima-Mangwe, 47; Bubi, 24; Gwanda, 2; Umzingwane, 48; Bulawayo, 13; Insiza, 3; Belingwe, 22; Gwelo, 24; Melssetter, 7; Victoria, 45.

SCREW WORM (MYIASIS) OF CATTLE.

Many cases reported from the Plumtree district, and a few from West Nicholson.

CONTAGIOUS ABORTION OF CATTLE.

Reports indicate that this disease is very prevalent.

HORSE-SICKNESS.

One horse died in Ndanga district.

TUBERCULOSIS.

At the Shangani Estate the pedigree herd was re-tested with tuberculin, and 10 animals out of 120 re-acted.

EPHEMERAL FEVER (THREE DAYS' SICKNESS) OF CATTLE.

A few cases reported from the Nyamandhlovu district.

IMPORTATIONS.

From United Kingdom:—Heifer, 1. From Union of South Africa:—Bulls, 30; cows and heifers, 24; horses, 122; mules, 47; donkeys, 31; pigs, 6; sheep, 2,463; goats, 430.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle, 438; breeding cattle via Liebig's Drift, 54; goats, 83; sheep, 155; pigs, 39. To Portuguese East Africa:—Horses, 3; working oxen, 39; slaughter oxen, 58; donkeys, 2; pigs, 17. To Congo:—Goats, 25; sheep, 45; pigs, 15. To Northern Rhodesia:—Pigs, 4.

November, 1921.

AFRICAN COAST FEVER.

No cases occurred during the month.

QUARTER-EVIL.

The following mortality was reported:—Bulawayo veterinary district, 25; Gwelo, 13; Victoria, 12; Umtali, 39; Melsetter, 10.

SCREW WORM (MYIASIS) OF CATTLE.

A few cases occurred in the Bulalima-Mangwe district.

CONTAGIOUS ABORTION OF CATTLE.

Centres of infection, previously unknown, were demonstrated in the Hartley, Mazoe, Lomagundi, Salisbury, Melsetter, Gwelo, Charter, Belingwe and Wankie districts.

EPHEMERAL FEVER (THREE DAYS' SICKNESS) OF CATTLE.

A few cases reported from Nyamandhlovu district. No mortality.

HORSE-SICKNESS.

One horse died in Hartley district, one in Lower Gwelo and one in Bulawayo.

GALL-SICKNESS OF CATTLE.

A number of cases reported from various districts.

TRYPANOSOMIASIS OF CATTLE.

Two head died in Hartley district.

CATTLE CLEANSING ORDINANCE, 1918.

Forty-eight convictions under this Ordinance for failing to dip and tick-infested cattle, with fines varying from 1s. to £10.

IMPORTATIONS.

From United Kingdom:—Bulls, 2. From Union of South Africa:—Bulls, 5; cows and heifers, 5; horses, 25; mules, 7; donkeys, 11; goats, 215; sheep, 2,082.

EXPORTATIONS.

To Union of South Africa:—Slaughter oxen, 477; breeding stock *via* Liebig's Drift, 153; pigs, 55. To Congo:—Pigs, 59. To Northern Rhodesia:—Pigs, 2; sheep, 42; goats, 25. To Portuguese East Africa:—Slaughter cattle, 84; pigs, 91.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

Farming Calendar.

February.

BEE-KEEPING.

In some districts a second flow of honey may be looked for from the veld flowers and late growing crops. Honey being secured in either sections or shallow frames should not be permitted to remain too long on the hive at this time of year, as it will become soiled with the bees' feet. Robbers may be anticipated, and this is a sign that the honey flow is nearly over. Where stocks are short of food, feed rapidly inside the hive; excellent feeders can be supplied by appliance dealers. Queenless stocks can now be re-queened, or two stocks can readily be united by previously dusting each lot with household flour. Grade and dispose of honey.

CITRUS FRUITS.

The notes on planting still apply, if trees are still planted this month, an operation which, however, it is not desirable to leave so late. Trees planted after about the end of January may only get established when it is too late that season for them to commence growth, the consequence being that what growth there is still sappy at the approach of the cold weather and so stands a chance of being nipped. In such case the tree would have been better left in the nursery row to be lifted and transplanted into the orchard the following spring.

By the end of February or early March the cover crop should be ready to plough into the orchard, with the possibility of sufficient rains after it is done to assist in rotting the plants in the soil. A continuous watch should be kept for insect pests, and fumigation or spraying undertaken immediately any pest is observed. If no cover crop has been sown, the orchard should be kept in a good state of cultivation, and not allowed to be overrun with grass and weeds. Destroy all fruit infested with citrus codling moth by burning or burying deeply. Do not allow the fruit to fall to the ground before destroying it, but pick all affected fruit as soon as it is observed. Considerable damage is done in some orchards by citrus codling moth, which can be controlled to some extent by using a poisoned bait made up as follows :

Arsenate of lead (paste), 2 lbs. or 3 ozs.
 Arsenate of lead (powder), 1 lb. or 1½ ozs.
 Treacle, 4 galls. or ½ gall.
 Or sugar (cheapest), 40 lbs. or 4 lbs.
 Water, 40 galls. or 4 galls.

Apply lightly in a coarse spray, getting a few large drops here and there throughout trees. Apply from beginning of the year until about early April every fortnight, and more frequently if rains wash off bait.

CROPS.

During this month the farmer's energies will be concentrated on keeping the lands thoroughly clean, and if this is done effectively now, no further serious damage from weeds need be feared. A special campaign should be waged against such weeds as Mexican marigold in the old lands, in headlands and on ant-heaps. Most summer crops will be in the ground. Maize for ensilage or fodder may still be sown, also catch crops of buckwheat and tef. The main

maize crop should be cleared of suckers, which can be fed to stock. The most vigorous plants should be marked for seed selection by cutting the stalk above the cob, and the date of tasselling should be noted both in the main crop and the ensilage crop. In case of excessive moisture, the use of the wing shovel plough may be necessary. Monkey nuts should not be cultivated after the period of flowering, which is usually early in February. Hay-making should start in February if weather conditions allow. The sooner the veld is cut for hay the better the product obtained. Land for winter crops of oats and wheat should now be got ready as weather conditions permit. Napier's fodder slips planted early in the season can be divided. Potatoes are sometimes planted this month in order to obtain seed for the early plantings the following season.

DECIDUOUS FRUITS.

This is the time to carry out summer pruning, after harvesting the crop, and when the flow of sap begins to become sluggish.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month, and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down (see March). Certain caterpillars are sometimes troublesome. See "Some Insect Pests of Maize," *Agricultural Journal*, June, 1912, "Some Injurious Caterpillars," *Agricultural Journal*, February, 1915, and "The Maize Stalk Borer," *Agricultural Journal*, December, 1917.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. See *Agricultural Journal*, December, 1919, and February, 1920.

Potato.—Ladybirds and tuber moth may call for attention; the latter, when very bad, sometimes causes considerable wilting of the crop besides attacking the tubers. See *Agricultural Journal*, October, 1913, and February, 1910.

Cabbage Family.—All members of the family are liable to the attack of sawfly and webworm during February. See *Agricultural Journal*, February, 1914; April, 1910; and April, 1911. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime. See *Agricultural Journal*, 1918.

Beans and Cowpeas.—These suffer chiefly from stem maggot and blister beetles, which destroy the blossoms. The latter must be collected by hand. The former is dealt with in the number of this *Journal* for April, 1913.

Melon Family.—The most important pest is the melon fly, which "stings" the fruit of all species of gourds. At present no remedy is known except collecting and destroying the infested fruit early in the season. Aphids on the leaves and shoots may be destroyed by careful spraying with tobacco and soap wash or paraffin emulsion.

Mangolds and Beets.—These are frequently defoliated by caterpillars. Spray with an arsenical wash.

Citrus Trees.—The chief pest requiring attention during February is citrus codling. The infested fruit should be gathered and destroyed regularly. The fruit is also apt to be attacked by large fruit-piercing moths, for which unfortunately no remedy is known. For these and other pests see *Agricultural Journal*, February, 1916.

Deciduous Trees.—Apple, pear and late peaches suffer chiefly from fruit moths which puncture the fruit. No remedy is known except netting the trees.

Fig.—The fruit is liable to the attack of fig weevil. Infested fruit and all wild figs near the trees should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon disulphide into the burrow and sealing it up.

Castor Oil.—Two-year-old plants which contain borer should be cut down and burnt. See *Agricultural Journal*, October, 1912.

Mosquitoes, House Flies, Stable Flies.—Destroy all breeding places round the homestead. Poison or trap adults. See *Agricultural Journal*, June, 1915, and December, 1916.

FLOWER GARDEN.

During this month the flower garden is gradually approaching perfection, and nearly all plants are in bloom. If these are constantly plucked the yield will be increased, and except where required for seed, all flowers should be removed as they fade, for seeding shortens the life of many plants. All runners and creepers should have constant attention, and be tied up and trained. Dahlias in more exposed positions should be carefully tied to their stakes, as they now become top heavy with the weight of their blooms. Palms in the house and conservatory will benefit much if occasionally put out in the rain. Winter flowering sweet peas, if not already planted, should be sown as early as possible.

FORESTRY.

Complete planting out of ever-greens. Sow in nursery seeds of slow growing species such as cypress, pines, etc. All planting should be completed this month, in the early part if possible.

GENERAL.

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition, but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It pays far better to get rid of all of the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they *must* be good, should be kept till about June; there is a demand for such up to this month, which then commences to slacken off. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve. No poultry keeper should sell his *best* stock, no matter how high a price is offered for it. If he does, he throws his operations back considerably.

By the end of this month the birds selected for breeding should be mated up. An article appears in this issue on the correct method of doing so; don't put it off, and do it properly. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter *must* be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks *must* be kept out of the sun and sleep on *dry* grass. Nothing is more fatal to ducklings than sun, and dampness at night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand, etc., covering the floor of it, is available, it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they

are almost certain to die. This and the feeding on wet mashes instead of dry food, chopped onions and thick milk are the chief reasons for non success in the breeding of turkeys.

STOCK.

Cattle. Grass will now be at its best, and no anxiety need be felt about feed. In the case of milking cows which have been fed during the earlier rainy months, a little crushed and soaked mealies, or something similar, may still be given at milking, if only to bring them quietly to their places. The importance of a clean, light, airy and well-drained shelter for calves cannot be over-estimated. Calves up to three or four months old do not require a great deal of exercise, and on wet days are better left in a dry shed with a little sweet hay. A few hours' exercise on bright days in short grass is all they need. Vigilance in keeping down ticks must not be relaxed. These remarks apply specially to milking herds and to cattle that are kraaled. Cattle running at large need little attention beyond dipping, and if the calves are not desired from November to March, the bulls must now be taken out of the herd. Weather permitting, no opportunity should be lost of getting in a supply of good sweet hay before the grass is too old.

Sheep.--Vleis and low-lying ground must be avoided. Sheds should be airy, dry and clean. If grass seeds are troublesome to woolled sheep, an area should be mown for them, or when rain begins to slacken, they may be shorn. If wire worm is troublesome, dose and move to fresh grazing and kraals.

TOBACCO

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping and suckering should be given attention. Selected seed plants should be given careful attention. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

VEGETABLE GARDEN.

Potatoes should receive attention and be carefully ridged up, and care taken that the stalks are not buried. Seeds for winter crops should be sown, such as beet, Brussels sprouts, cabbage, carrots, beans, peas, onions, turnips, tomatoes, etc. Vegetables planted out during this month might be placed a little closer together than usual, as watering may have to be resorted to before they mature.

WEATHER.

This is generally the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, $7\frac{1}{2}$ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

March.

BEE-KEEPING.

Be on the look-out for damage to stocks by the wax moth; strong stocks generally tend to obviate this pest. Where the heavy rains have penetrated the weak hive roofs and caused dampness among the quilts, these should be taken off and thoroughly dried in the sun, then replace. Contract the entrances of hives to prevent robbing. Unsold honey should be stored in a warm dry cupboard. Keep apiary clear of weeds.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irrigation, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until latter end of April.

CROPS.

For general cultural treatment, see February notes. Mangels, turnips, rape and kale for autumn feeding may be sown in vleis or under irrigation during the latter half of this month. Haymaking will continue. Land for winter crops of oats and wheat should now be ready. The division of Napier fodder slips can be continued up to the end of this month. Buckwheat, linseed, teff grass and manna will be ready for reaping this month. The silo pit should now be got ready. Maize will be ready for ensilage in four to five weeks after the period of tasselling.

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood will be found freely in the stalks, but nothing can be done at this stage. Caterpillars may attack the crop during this month, usually as a sequence to cultivation after the weeds have been allowed to get too far ahead. The caterpillars attack the crops on account of their food being suddenly destroyed. See "Some Insect Pests of Maize," *Agricultural Journal*, June, 1912; "Some Injurious Caterpillars," *Agricultural Journal*, February, 1915; and "The Maize Stalk Borer," *Agricultural Journal*, December, 1917.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but any plants still infested with stem borer should be removed and burned. Leaf miner will still be in evidence, and budworms may put in an appearance. See *Agricultural Journal*, December, 1919, and February, 1920.

Potato.—Ladybirds may still be injurious. See *Agricultural Journal*, October, 1913. Careful hilling should be attended to on account of the tuber moth. See *Agricultural Journal*, February, 1910.

Cabbage Family.—Sawfly. See *Agricultural Journal*, June, 1918. The fly will probably be less injurious by this time. Cabbage louse may be on the increase. Very thorough spraying with tobacco wash and soap is of value when the plants are young.

Beans and Cowpeas.—The most obvious enemies are the blister beetles, which destroy the blossoms. These can only be destroyed by hand. Stem maggot continues injurious, causing dropping of leaves on the larger plants, but little can be done at this stage.

Melon Family.—Plants of this family are subject to the attack of melon fly and aphids. Careful spraying with tobacco wash or paraffin emulsion is of value against the latter.

Sweet Potato.—Hawk moth caterpillars occasionally appear in countless thousands and defoliate the crop. Immediate spraying with an arsenical wash is called for when the insects first appear. See *Agricultural Journal*, June, 1912.

Citrus Trees.—Attention should constantly be given to the systematic collection and destruction of infested fruit to keep down the citrus codling.

Large fruit-piercing moths may attack the fruit during the month (see under February).

Deciduous Trees.—But little damage from insects is likely to occur to these fruits during March.

Fig.—Fig weevil still calls for attention in collecting and destroying the infested fruit.

Castor Oil.—See under February.

Mosquitoes, etc.—See under previous month.

FLOWER GARDEN.

During this month the garden should be seen at its perfection, and, owing to our rains, requires a great deal of attention in order to keep the soil free from weeds and caking. Drainage should also be looked to, in order to avoid plants being swamped or washed away. Dahlias and carnations should now be in their heaviest bloom, and will require tying up, and the dying blooms should be removed, in order to prolong their flowering period. Plants for winter flowering should now be coming on and planted out. Cuttings of carnations may now be made, and should be picked from the choicest plants, and taken from stems which have borne the finest blooms. The cuttings should be placed in boxes containing sand, and kept in a moist condition in a warm position sheltered from the winds. These should be ready for planting out in about two months, and bloom in three. Carnations, verbena, antirrhinum, penstemon, pansy, dianthus, phlox, calliopsis and escholtzia may be sown for early blooming next spring.

FORESTRY.

If necessary, cultivate between the rows of trees planted out in the previous months. Plough any fire lines that are necessary and break up any new ground that will be required for next season's planting. Remember that the roots of trees penetrate deeply into the ground, and therefore plough as deeply as possible. Where black wattle thrives, sow seed this month, after well soaking.

GENERAL.

At this time the condition of stock on the veld is good—perhaps at their best. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

All breeding pens should now have been mated and some eggs set. It is as well to note that the fresher an egg is when set, the better it will hatch and the stronger will be the chick from it. No eggs more than a week old should be set in an incubator or more than ten days old under a hen. Many are very hazy as to how many hens should be given to one rooster. There is no definite number; the whole point hinges upon the size of the run and the amount of scratching exercise the birds are made to take. A rooster put into a run, say, 10 ft. square could be given only two hens, but the same rooster running on absolutely free range could be given fifty, and if all the birds are in good condition and made to take plenty of scratching exercise, practically all the eggs would be fertile. The same applies to ducks and turkeys.

When setting eggs under hens, the result of the hatch, good or otherwise, is chiefly due to the owner. If the eggs are from strong, healthy stock, and are not too old, if the nest is properly made in a cool, quiet, darkish place, kept clean and free from insects, and the hen properly fed and kept clean, the result will be good. If these precautions are not taken, the result will be failure, and the fault is not with the sitting

hens. An article on incubation and rearing of chicks for best results will be found in the *Agricultural Journal* for April, 1921, and every poultry keeper is advised to study it carefully and act upon it closely if good hatching and rearing is to be expected.

Turkey eggs can now be set with safety, for by the time they hatch the rains will practically be over, and turkeys hatched now will be of good size for the following Christmas market and should fetch from 30s. to £2 10s. each as killing birds. The right time to buy turkey breeding stock is in February. When buying, go to a reliable breeder of pure-bred American Bronze turkeys; this variety is the best. It pays far better to breed from good, pure stock than from cross-bred. Don't hesitate to hatch as many stock as possible.

STOCK.

Cattle.—The precautions recommended for February apply equally to March. Arrangements should be completed for storing as much silage as it is proposed to make, so that the crops reserved for this purpose may be harvested immediately they are ready.

Sheep.—The same precautions as for February should be taken, but as less rain may be expected, conditions will probably be more favourable. If late winter lambs are not desired, the rams should be removed from the flock.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed.

VEGETABLE GARDEN.

Tomatoes, peas and beans should be in full bearing, and should be staked and tied. Weeding and cultivation should be extensively carried out. Seeds for late winter crops—beans, cabbage, cauliflower, peas, radish, turnips, spinach and beet—should be sown.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy season tapers off in an irregular and often erratic manner and without certainty.

Weather Bureau.

The mean barometric pressure during the month of November was normal in Matabeleland and slightly below normal (0.01 inch) in Mashonaland. High pressures were recorded at Salisbury and Bulawayo on the 1st, 7th, 15th and 26th, the maximum high on the 1st being 0.15 above normal at Bulawayo and 0.10 above normal at Salisbury. Low pressures were recorded at Salisbury on the 4th, 12th, 20th and 29th, and at Bulawayo on the 4th, 12th, 21st and 28th. The minimum low at Salisbury was 0.11 below normal on the 29th, and at Bulawayo 0.19 below normal on the 12th. During December the mean barometric pressure was 0.025 inch below normal in Matabeleland and 0.054 inch below normal in Mashonaland. High pressures were recorded at Salisbury and Bulawayo on 2nd, 7th, 16th and 22nd, the maximum high on the 2nd being 0.05 above normal at both Salisbury and Bulawayo. Low pressures were recorded at Salisbury and Bulawayo on the 12th, 19th and 30th, the minimum low on the 12th being 0.11 below normal at both Salisbury and Bulawayo.

During November the mean temperature was 1 deg. to 1.5 deg. below normal over the whole country. At Bulawayo the mean daily temperature was 2.4 deg. below normal, and the mean night temperature 0.5 deg. below normal. In December the mean temperature was 1.5 deg. to 2 deg. below normal over the whole country. At Bulawayo the mean daily temperature was 2.2 deg. below normal, and the mean night temperature was 1.5 deg. below normal. The mean seasonal rainfall to the end of December was above the average over the whole country, with the exception of Zone F, where there was a mean deficiency of 0.80 inch, the excess in the other zones varying from 0.40 inch in Zone B to 3.20 inches in Zone C. As regards individual districts in these zones, it may be noted that the mean fall was below normal over Bulalima-Mangwe, Mrewa, Mtoko and Umtali districts, the deficiency varying from 0.60 to 1.30 inches. The greatest departure from normal was in Chilimanzi district, where the mean fall was 7 inches above normal.

During the period November and December the rainfall was above the average in all zones, with the exception again of Zone F, where the mean deficiency was 1.40 inches, the excess in the other zones varying from 0.70 inch in Zone B to 3.20 inches in Zone C. In these zones individual districts in which there was a deficiency in the mean fall were Bulalima-Mangwe, Mrewa, Makoni and Umtali, the deficiency varying from 0.30 to 1.60 inches. The bulk of the excess noted occurred during the month of November, whilst the fall during the month of December was more nearly normal over the whole country. Individual stations showing the greatest deviations from normal were Sinoia and Gutu 79 per cent. and Enkeldoorn 66 per cent. in excess, whilst Umtali shows the greatest deficiency, being 56 per cent. below normal.

At the time of writing these favourable conditions had not been maintained, and the prospects for the general rains do not appear good, there having only been one small fall since 1st January.

RAINFALL.

STATION.	1921.		Total to end of period.	Normal rainfall to end of period.
	Nov.	Dec.		
ZONE A. :				
Bubi—				
Imbesu Kraal	5·99	7·24	15·37	9·88
Inyati	2·86	5·95	10·74	9·81
Bulalima—				
Kalaka	2·96	3·76	7·79	9·10
Riverbank	3·87	2·91	7·79	9·56
Bulawayo—				
Fairview Farm	5·14	2·97	8·89	9·29
Keendale	5·19	5·72	12·68	9·06
Lower Rangemore	4·44	4·20	10·62	9·77
Observatory	4·74	6·31	11·76	9·70
Paddy's Valley	5·11	6·08	14·15	9·65
Gwelo—				
Riverdale	3·89	...	...	...
Somerset Estate	5·47	5·34	11·93	9·89
Wankie—				
Waterford	4·64	4·67	10·02	9·60
Sebungwe—				
Gokwe	5·08	6·43	12·62	12·07
ZONE B. :				
Belingwe—				
Bickwell	6·64	4·60	11·98	8·65
Bubje Ranch	3·97	1·97	6·65	8·60
Bulalima—				
Garth	4·96	3·21	8·68	10·42
Retreat	2·71	4·32	7·52	8·47
Tjankwa (Syringa)	5·30	1·88	7·88	9·67
Tjomanpie	4·85	3·00	9·62	9·77
Gwanda—				
Gwanda Gaol	4·80	3·59	9·02	8·33
Mtshabezi Mission	6·27	1·83	8·44	9·20
Tuli	6·14	1·89	8·48	5·95
Insiza—				
Albany	4·58	3·97	9·58	8·50
Filabusi	6·72	3·63	10·61	8·68
Fort Rixon	5·09	5·02	10·87	8·83
Inipingwe	4·02	5·09	9·45	8·43
Inyezi	6·86	5·77	6·94	8·71
Matobo—				
Holly's Hope	3·43	4·02	7·98	5·98
Rhodes Matopo Park	5·05	...	...	...
Umzingwane—				
Essexvale	3·85	4·17	9·14	8·31

RAINFALL—(Continued).

STATION	1921.		Total to end of period.	Normal rainfall to end of period.
	Nov.	Dec.		
ZONE C. :				
Charter—				
Bushy Park	4.28	4.14	10.60	9.78
Enkeldoorn	7.07	8.76	17.82	10.73
Marshbrook	5.69	6.44	14.89	10.85
Range	7.50	7.38	16.12	10.53
Umniati	2.94	6.00	10.56	10.01
Vrede	4.91	4.75	10.23	10.68
Chilimanzi—				
Wylde Grove	6.29	9.77	16.67	9.53
Gwelo—				
Cross Roads	3.24	7.80	13.04	10.14
Globe and Phoenix Mine	8.84	5.33	14.86	9.86
Rhodesdale Ranch	5.92	3.22	10.78	9.71
Woodenhove	5.47	4.72	10.06	10.98
Gwelo (Gaol)	4.79	6.47	11.42	10.64
Hartley—				
Ardgowan	6.03	11.70	20.21	10.24
Beatrice... ..	3.94	7.62	14.63	9.80
Carnock	5.18	5.47	12.41	11.05
Philippaugh	4.55	11.02	16.88	10.79
Cromdale	2.99	5.31	9.92	9.80
Elvington	5.62	6.55	14.26	11.77
Gatooma	4.96	9.38	15.67	11.07
Gowerlands	4.27	7.01	12.90	10.18
Hallingbury	2.69	7.78	12.58	11.20
Hartley Gaol	3.58	7.88	13.76	11.87
Jenkinson	4.95	8.56	15.09	10.20
Nyagordi	5.56	7.15	14.60	10.25
Ranwick	4.45	9.44	15.05	10.13
Spitzkop	5.57	7.98	14.20	10.35
Lomagundi—				
Argyle	2.89	10.01	14.75	10.98
Darwendale	3.59	4.26	9.88	10.28
Gambuli	1.97	8.65	12.78	11.32
Lone Cow Estate	3.45	7.07	13.70	10.47
Maningwa	2.26	10.27	14.00	10.35
Mrindagomo	1.91	6.16	10.40	10.50
Mukwe River Ranch	2.13	9.16	12.99	10.34
Palm Tree Farm	2.44	7.83	12.67	10.81
Sinoia	4.29	11.05	18.60	10.38
Sipolilo	4.95	5.91	10.93	10.43
Talfourd	1.86	8.62	11.52	10.68
Salisbury—				
Avondale	3.37	8.58	13.79	11.70
Botanical Experiment Station... ..	2.81	4.36	9.58	11.60
Bromley	4.24	7.32	15.11	12.45
Cleveland Dam	2.45	7.11	12.38	9.57
Gwebi	2.66	5.16	9.29	11.12
Hillside	2.30	5.70	10.56	10.52
Lilfordia	5.24	6.83	13.77	10.36
Salisbury Gaol	2.73	5.24	9.27	11.04

RAINFALL (*Continued*).

STATION.	1921.		Total to end of period.	Normal rainfall to end of period.
	Nov.	Dec.		
ZONE C.—(Continued)				
Salisbury—continued				
Sebastopol	4·03	6·20	12·17	10·80
Stapleford	2·24	...	...	...
Tisbury	4·03	6·37	12·50	11·20
Vainona	4·56	6·48	12·60	12·21
ZONE D. :				
Darwin—				
Mount Darwin	6·32	7·90	15·21	10·27
Inyanga—				
Inyanga	4·57	6·68	13·03	11·43
Rhodes Estate	4·77	6·42	14·37	11·18
Makoni—				
Eagle's Nest	5·49	...	...	...
Wensleydale	2·21	7·36	10·84	10·65
Mazoe—				
Benridge	3·65	5·91	10·54	10·49
Bindura	4·21	6·76	11·50	10·09
Ceres	3·50	6·99	11·76	10·81
Citrus Estate	1·79	5·36	9·21	10·45
Craigengower	3·57	8·04	13·56	10·83
Kilmer	4·45	4·59	11·14	10·86
Kingston	6·38	8·62	16·53	11·27
Mazoe	2·36	9·31	14·50	9·74
Mazoe Dam (centre)	2·72	6·56	11·27	11·14
Omeath	3·87	8·73	13·72	9·23
Ruia	1·79	6·38	8·52	10·93
Ruoko Ranch ... ..	...	9·71	...	...
Rustington	2·99	4·44	8·51	10·50
Shamva	4·05	5·69	10·60	10·57
Stanley Kop	1·63	7·96	11·76	10·23
Sunnyside	1·60	10·54	13·32	10·23
Teign	2·06	11·61	14·93	10·38
Virginia	2·83	6·33	10·38	9·51
Zombi	4·44	10·37	16·27	10·70
Mrewa—				
Glen Somerset	1·99	5·18	8·72	11·92
Mrewa	6·09	6·42	13·68	11·60
Selous Nek	4·16	6·12	12·07	12·78
Mtoko—				
Makaha	3·30	4·96	8·51	11·36
Mtoko	4·29	6·19	11·58	10·02
Salisbury—				
Glenara	3·75	10·33	16·22	11·14
Goromonzi	3·32	...	...	...
Borrowdale	2·96	6·97	12·68	10·61
Meadows	4·15	6·85	13·78	12·78
ZONE E. :				
Charter—				
Buhera	7·75	6·13	14·93	9·05
Chilimanzi—				
Chilimanzi	5·90	5·15	12·67	9·73

RAINFALL—(Continued).

STATION.		1921.		Total to end of period.	Normal rainfall to end of period.
		Nov.	Dec.		
ZONE E.—(Continued)					
Chilimanzi—continued					
Driefontein	...	7.48	6.35	14.41	10.00
Felixburg	...	8.75	7.28	16.90	9.90
Grootfontein	...	9.28	5.13	14.90	10.15
Induna Farm	...	6.50	12.32	19.18	12.42
Gutu—					
Gutu	...	8.69	9.33	18.33	10.22
M'vimvi Ranch	...	12.21	5.35	19.85	10.30
Tel-el-Kebbi	...	6.89	5.73	13.38	10.15
Gwelo—					
Ballock	...	3.91	5.99	10.06	11.20
Lovers' Walk	...	4.48	...	...	...
Oaklands	...	5.61	8.33	14.17	11.96
Partridge Farm	...	8.29	9.13	17.86	11.40
Sheep Run Farm	...	6.81	...	...	...
Belingwe—					
Belingwe	...	...	...	...	...
Insiza—					
Thornville	...	5.45	...	...	...
Inyanga—					
St. Trias' Hill	...	3.88	7.90	12.93	13.07
Makoni—					
Chimbi Source (Chitora)	...	4.00	3.18	9.71	12.14
Craigendoran	...	3.47	...	...	...
Forest Hill	...	3.37	3.43	9.71	11.33
Gorubi Springs	...	3.99	4.41	9.36	11.43
Mona	...	4.90	6.94	14.61	12.14
Monte Cassino	...	6.48	...	...	...
Rusape	...	3.57	5.80	12.33	10.37
Springs	...	4.11	5.06	11.83	11.18
Marandellas					
Bonongwe	...	7.76	7.23	18.29	11.36
Delta	...	3.84	6.21	12.38	12.37
Land Settlement	...	5.67	4.35	11.84	10.70
Lendy Estates	...	...	...	...	...
Marandellas	...	5.63	9.09	17.82	12.37
Nelson	...	5.27	...	...	...
Melssetter—					
Brackenbury	...	6.29	9.06	17.44	18.11
Melssetter	...	7.40	5.71	17.04	15.44
Tom's Hope	...	5.95	9.29	19.52	15.88
Ndanga—					
Bikita	...	8.72	...	...	...
Doornfontein	...	8.35	5.02	14.66	10.30
Ndanga	...	5.76	3.11	10.52	14.44
Triangle Ranch	...	2.85	...	...	...
Selukwe—					
Hillingdon	...	4.01	9.10	13.84	10.59
Rio	...	5.80	8.73	15.00	9.71

RAINFALL (*Continued*).

STATION.	1921.		Total to end of period.	Normal rainfall to end of period.
	Nov.	Dec.		
ZONE E.—(Continued)				
Umtali—				
Gilmerton	3·21	3·83	7·82	10·46
Jerain	2·87	...	...	...
Mutambara Mission	3·70	3·24	11·43	9·61
Odzani Power Station	2·95	9·07	15·22	12·40
Premier Estate	2·46	5·75	9·64	11·22
Stapleford	4·79	19·54	31·96	21·37
Umtali (Gaol)	1·78	2·13	4·95	11·30
Victoria—				
Cavan	4·50	5·90	10·64	11·12
Clipsham	4·71	3·13	8·51	11·36
Gokomere	8·24	4·90	13·91	10·56
Histönhurst	5·97	2·64	9·38	10·60
Makahori Farm	7·60	4·93	13·11	10·52
Makorsi River Ranch	7·33	4·18	12·18	11·55
Morgenster Mission	6·05	...	...	...
Riverdene North	5·51	2·69	9·05	10·80
Silver Oaks	6·59	2·60	9·69	11·25
Stanmore	5·06	4·27	10·89	10·85
Summertown	6·14	7·17	13·83	10·50
Tichidza	3·80	5·73	11·90	10·75
Victoria	5·99	4·56	11·30	10·08
ZONE F.:				
Melsetter—				
Chikore	6·82	4·92	15·82	13·20
Chipinga	4·51	5·89	17·82	...
Helvetia	6·69	...	...	...
Mount Selinda	5·57	6·34	20·49	18·86
Vermont	5·90	...	...	...
Umtali—				
Hoboken	3·76	7·70	15·51	16·00

... means nil.

Dates of Meetings of Farmers' Associations, Southern Rhodesia

(SUBJECT TO ALTERATION)

Name of Association	Place of Meeting	Secretary	1922		
			February	March	April
Banket Junction ..	Banket Hotel ..	Hon. J. S. Parker ..	4	11	1
Bindura ..	Bindura ..	G. Askew ..	11	2	8
Bromley ..	Bromley ..	C. R. Deary ..	23	30	27
Charter-Ngesi ..	Farmers' Hall, Beatrice ..	W. Krienke ..	..	31	28
Central Darwin ..	Arcadia Farm and Mt. Darwin Store ..	..	..	..	..
Eastern Border (South Melssetter) ..	alternately ..	J. W. Giles ..	12	12	9
Edmore ..	Farm House ..	J. T. Rademeyer ..	10	11	7
Edmore Districts ..	Good Hope School ..	J. T. Rademeyer ..	10	11	8
Enterprise ..	Artcurus Hotel ..	Mrs. V. J. Freere ..	..	1	5
Felixburg-Gutu ..	Willand Farm ..	F. W. Bradshawe ..	11	11	8
Figtree Branch, R.L. and F.A. ..	Figtree Hotel ..	A. S. Will ..	22	22	26
Gabazi ..	Hunyani Drift ..	A. Kelsey-Harvey ..	10	16	20
Gatooma ..	Speck's Hotel ..	K. Seal ..	18	18	15
Gazaland ..	Chippinga ..	W. K. Koor ..	..	..	..
Greystone ..	W. K. Koor ..	..	..	..	..
Groote ..	W. K. Koor ..	..	..	..	..
Headlands ..	Royal Hotel, Gwanda ..	A. C. Edmonstone ..	18	fixed	dates
Hartley ..	Headlands ..	J. de L. Nimmo ..	25	25	22
Hunter's Road Farmers and Stockowners ..	Hunter's Road Siding ..	J. Grewar ..	..	..	..
Inanga ..	Shangani ..	R. W. Twilley ..	11	11	8
Inyanga ..	Rhodes Inyanga Estate ..	M. E. Weale ..	18	18	15
Inyanga ..	Indaba ..	G. H. E. Wack ..	21	21	18
Jonah ..	Jonah ..	G. H. E. Wack ..	21	21	18
Leopards ..	Sinola ..	R. E. Courthope ..	20	20	17
Leopards ..	Sinola ..	J. G. Clarkson ..	11	11	8
Macheke ..	Macheke ..	W. L. McLean ..	..	..	..
Makoni North ..	Makoni South Farm ..	D. M. Sime ..	..	..	..
Makoni ..	Makoni ..	J. G. Monckton ..	22	29	26
Marandellas, Northern ..	Rusape ..	H. J. Doherty ..	11	11	8
Marandellas, Southern ..	Marandellas Farmers' Hall ..	H. J. Doherty ..	11	11	8
Matopo ..	Commercial Hotel, Salisbury ..	F. N. Gibson ..	1	1	5
Matopo Branch, R.L. and F.A. ..	Various farm houses ..	Robertson ..	2	2	6
Mazoe ..	Glendale ..	G. G. Coghill ..	..	..	..
Mazoe Central ..	Mazoe ..	Mrs. Dudley Davis ..	..	..	..
Melsetter ..	Melsetter ..	P. D. Peacey ..	10	18	14
Melsetter (North) ..	Cronley ..	H. J. Doherty ..	..	..	..
Midlands Farmers and Stockowners ..	Royal Hotel, Gwelo ..	M. Doherty ..	4	10	fixed
Northern ..	Farm Summerfield ..	A. Tulloch ..	21	21	18
Northern District ..	Norton Store ..	W. Wrench ..	4	4	fixed
Nyamandlovu ..	Nyamandlovu ..	G. Graham ..	..	..	..
Que Que ..	Que Que ..	E. J. Ross ..	..	..	..
Rhodesian Landowners and Farmers ..	Library Buildings, Bulawayo ..	H. S. Hopkins ..	18	18	15
Selous ..	Various farms ..	A. E. Douglas ..	..	..	..
Sekake ..	Sekake ..	A. E. Douglas ..	16	16	13
Shamva ..	Shamva ..	A. E. Douglas ..	11	11	8
Swanepoort ..	Swanepoort ..	A. E. Douglas ..	11	11	8
Umtali ..	Royal Hotel, Umtali ..	J. S. Holland ..	2	2	6
Victoria ..	Victoria ..	Major A. J. Dunn ..	3	3	7
Western ..	Plumtree Hotel ..	W. R. Boucher ..	11	11	8

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

CO-OPERATIVE EXPERIMENTS.

WINTER CEREALS.

With a view to promoting the growing of winter cereals, both under irrigation and on vleis soils, and also of introducing new varieties which may prove superior to those at present grown, it is anticipated that the following varieties will be available for free distribution in small quantities from the beginning of March onwards:—

Wheat.—Early Gluyas, Early Australian, Klein Koren, Wol Koren, Lang Koren, Black Persian.

Barley.—Smyrna—malting type.

Oats.—Boer and Burt.

Rye.—Cape Early.

Emmer.

At the date of going to press it is not certain that all the above varieties will be obtainable. In any case, stocks are limited, and not more than three parcels of seed can be sent to any one applicant.

All applications should be addressed to the *Chief Agriculturist and Botanist, Department of Agriculture, Salisbury*.

The terms under which seeds are issued for co-operative experiments are as follows:—

“That the recipient is required at the close of the season to forward to the Department of Agriculture, on forms supplied for that purpose, an accurate report on the result of his experiments with any seeds or plants supplied to him as a free issue.”

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 170. Production of Pedigree Seed—Maize, by H. Godfrey Mundy, F.L.S.
- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 176. The Cultivation of Castor Oil Beans, by H. G. Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 252. Cultural Notes on Buckwheat, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 293. Some Useful Crops for Granite Veld Farms, by R. C. Simmons.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 396. Export of Maize.
- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.

- No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
 No. 400. Soil Washing, by A. C. Jennings, Assoc.Mem.Inst.C.E.
 No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
 No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia. Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
 No. 189. The Manuring of Maize on the Government Experiment Farm. Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
 No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
 No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
 No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
 No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
 No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
 No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
 No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
 No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
 No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
 No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
 No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
 No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.
 No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.

TOBACCO.

- No. 132. Sumatra Tobacco, Hints to Rhodesian Growers, by C. J. Sketchley
 No. 144. Rhodesian Tobacco—Prospects of an Australian Market, by Eric A. Nobbs, Ph.D., B.Sc.
 No. 333. Tobacco Culture—Field Operations, by H. W. Taylor, B.Agr.
 No. 339. Tobacco Culture; Harvesting and Curing, by H. W. Taylor, B.Agr.
 No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
 No. 347. Tobacco Pests of Rhodesia, by R. W. Jack, F.E.S.
 No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
 No. 398. Wildfire and Angular Spot.
 No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision), by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.
 Handbook of Tobacco Culture for Planters in Southern Rhodesia, price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
 No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.

- No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 247. Statistical Returns of Crops grown by Europeans in Southern Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S., Statistician.
- No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
- No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.
- No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia, 1919-1920, by H. C. K. Fynn.
- No. 393. Statistics of Live Stock and Animal Produce for 1920, by H. C. K. Fynn.

LIVE STOCK.

- No. 123. Feeding and Care of Imported Bulls, by R. C. Simmons.
- No. 208. Water in the Diet of Live Stock, by L. E. W. Bevan, M.R.C.V.S.
- No. 210. The Care and Feeding of Calves in Dairy and Stud Herds, by R. C. Simmons.
- No. 227. An Experiment in Beef Production, by R. C. Simmons.
- No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
- No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by A. G. Holborow, F.I.C., Assistant Government Agricultural Chemist.
- No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
- No. 255. Pound Fees.
- No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed Farms, by R. C. Simmons.
- No. 292. Branding and Drafting Pens, by R. C. Simmons.
- No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
- No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
- No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
- No. 336. Butchering and Flaying.
- No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
- No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.
- No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.
- Arsenite Cattle Dip—How to Mix.

DAIRYING.

- No. 243. Shedding for Milch Cows, by R. C. Simmons.
- No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.

- No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
- No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
- No. 356. Cream and its Production, by T. Hamilton.
- No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 395. Farm Butter Making, by T. Hamilton, M.A., N.D.D., N.D.A.
- No. 401. Milk Records and Milk Testing, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
 - No. 95. Oestrus-ovis in Sheep, by Alec King.
 - No. 121. Rabies, by Ll. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
 - No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
 - No. 202. Distomatosis or Liver Fluke in Cattle and Sheep, by Rowland Williams, M.R.C.V.S.
 - No. 289. Contagious Abortion in Cattle, by Sir Arnold Theiler, K.C.M.G.
 - No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.
 - No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by Ll. E. W. Bevan, M.R.C.V.S.
 - No. 324. Infectious Abortion of Cattle, by Ll. E. W. Bevan, M.R.C.V.S. Services of Government Veterinary Surgeons.
 - No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.
 - No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.
- Redwater Treatment and Gall Sickness.

IRRIGATION.

- No. 186. Concrete and Reinforced Concrete, by E. Hardcastle, M.I.E.E.
 - No. 206. Hints on Irrigation: Small Earthen Storage Reservoirs, by W. M. Watt.
 - No. 270. Odzani River Irrigation Scheme, by W. M. Watt.
 - No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.
 - No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
 - No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.
 - No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.
- Engineering Advice.

FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.
- No. 217. Windbreaks and Hedges, by F. B. Willoughby.
- No. 234. Eucalypts suitable to Southern Rhodesia, and how to Grow them, by F. B. Willoughby.
- No. 267. Trees for Farm and Ornamental Purposes, by W. E. Dowsett.
- No. 366. The Management of Woods, by J. S. Henkel.
- No. 379. Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds.
- No. 386. Forestry in Rhodesia: Improvement Fellings on the Farm, by J. S. Henkel.

HORTICULTURE.

- No. 75. Fumigation of Fruit Trees with Hydrocyanic Acid Gas, by R. W. Jack, F.E.S.
 No. 354. The Home Orchard, by A. G. Turner.

ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
 No. 147. Root Gallworm, by R. W. Jack, F.E.S.
 No. 158. Two Ladybirds Injurious to Potato Plants, by R. W. Jack, F.E.S.
 No. 171. The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants, by R. W. Jack, F.E.S.
 No. 172. Diseases of the Potato Tuber and the Selection of Sound Seed, by R. W. Jack, F.E.S.
 No. 178. Illustrations of Natural Forest in relation to Tsetse Fly, by R. W. Jack, F.E.S.
 No. 187. The Dusty Surface Beetle, by Rupert W. Jack, F.E.S.
 No. 197. Chafer Beetles, by R. W. Jack, F.E.S.
 No. 204. Some Injurious Caterpillars, by R. W. Jack, F.E.S.
 No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
 No. 219. More Household Insects, by R. Lowe Thompson, B.A.
 No. 233. Does it Pay to Spray Potatoes in Southern Rhodesia? by Rupert W. Jack, F.E.S.
 No. 249. Home-made Fly Papers, by Rupert W. Jack, F.E.S., Government Entomologist.
 No. 261. Turnip Sawfly, by R. W. Jack, F.E.S.
 No. 276. The Maize Stalk Borer, by Rupert W. Jack, F.E.S.
 No. 280. The Maize Beetle, by R. W. Jack, F.E.S.
 No. 290. Notes on Remedies for Turnip Sawfly, by Rupert W. Jack, F.E.S.
 No. 291. Cutworms, by Rupert W. Jack, F.E.S.
 No. 302. A Note on the Maize Stalk Borer, by Rupert W. Jack, F.E.S.
 No. 317. Maize Culture on Red Soil; Value of Poisoned Bait as an Aid to Good Stands, by Rupert W. Jack, F.E.S.
 No. 353. Further Experiments with Poisoned Bait on Maize Lands, by R. W. Jack, F.E.S.
 No. 369. The Bean Stem Weevil, by R. W. Jack, F.E.S.
 No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.
 No. 402. Ticks Infesting Domestic Animals in Southern Rhodesia, by R. W. Jack, F.E.S.

POULTRY.

- No. 371. Ducks, by A. Little.
 No. 377. The Fowl Tick, by A. Little.
 No. 387. Prevention of Disease among Poultry, by A. Little.
 No. 390. Poultry Husbandry: The Incubation and Rearing of Chicks, by A. Little.
 No. 406. The Turkey, by A. Little.

MISCELLANEOUS

- No. 93. Formation of Agricultural Credit Associations in Rhodesia, by Loudon M. Douglas, F.R.S.E.
 No. 129. How to Make Use of the "Fencing Ordinance, 1904," by N. H. Chataway.
 No. 226. Classification of Clouds, by R. H. Scott, F.R.S.
 No. 254. Hints on Explosives, by W. M. Watt.

-
- No. 264. Nature Notes—Adaptation, by C. F. M. Swynnerton, F.L.S.
 No. 273. Enkeldoorn Produce Express Syndicate Rules.
 No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G.,
 M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.
 No. 283. Maize Foods for the Home.
 No. 294. Directions for taking Samples for Analysis, by E. V. Flack, Acting
 Agricultural Chemist.
 No. 318. Notes on Mining Law for Farmers, by Advocate D. E. McCausland,
 M.A., LL.B.
 No. 358. Notes on the Regulations governing the Sale of Fertilisers and
 Farm Foods, by E. V. Flack.
 No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by
 C. L. Robertson, B.Sc., A.M.I.C.E.
 No. 391. Hints on Brickmaking, by G. T. Dyke.
 Malarial Fever : How it is caused and how it may be prevented,
 by Sir Ronald Ross, F.R.C.S., D.Sc., LL.D., F.R.S., K.C.B.,
 etc.
 Directory of Rhodesian Farmers and Ranchers.
 The Analyses of Agricultural Products, Soils, Water, etc.
 Lectures for Farmers.
-

Sunflower Seed for Export.

The Beira and Mashonaland and Rhodesia Railways have reduced the rate for sunflower seed for export. The new rate is 26s. 9d. per ton for sunflower seed in minimum quantities of 10 tons when consigned to Beira for export oversea from all points 300 to 600 miles from Beira. The reduced rate took effect from 1st January.

Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No 593 of 1921.]

[16th December, 1921.

"CATTLE CLEANSING ORDINANCE, 1918."

IT is hereby notified that His Honour the Administrator has been pleased, under the provisions of section 8 of the "Cattle Cleansing Ordinance, 1918," to declare the following areas to be exempted from the obligations of sections 5 and 6 of the said Ordinance, in lieu of the areas set out in Government Notices Nos. 477 of 1920 and 256 of 1921:—

- 1 The native district of Sebungwe Port of exit—Farm Sikombella. .
2. That portion of the native district of Inyanga lying east of a line drawn from the Anglo-Portuguese boundary up the Ruenya and Chinyika Rivers to the confluence of the Inyamakwakwa River with the latter; thence in a direct line eastward to the north-western beacon of the farm Wheatlands; thence along the northern boundaries of the same and Barvydale to the north-western beacon of the latter; thence southwards along the western boundaries of Scotsdale, Inyanga Block, Holdenby and Umtasa North Reserve to the Hondi River. Ports of exit—Matiza Dipping Tank and Inyanga Slopes.
3. The native district of Bikita Port of exit—Nyika Tank.
- 4 The native district of Ndanga, excluding that portion lying north of a line drawn from the Chinyangara Hill due west to the Chiredzi River, thence down this river to where it crosses the northern boundary of Allandale Farm; thence along the northern, eastern and southern boundaries of this farm to the Chiredzi River; thence down this river to Mount Mawurudzana; thence in a westerly direction following a line along the northern side of the following hills.—Ruwashe, Mashawa, Wuroyi, Sidza, Mututu, Guwuguru, Chiwingwi, Mukuni, Matanga and Makwato. Ports of exit—Ndanga and Neswiconde Tanks.
5. That portion of the native district of Umtali lying west of the Odzi River. Ports of exit—Riverside and Killridge.
6. In the native district of Melsetter, the Mutambara and Muwushu Native Reserves, the unalienated land south of the Tanganda River, the Musikiwani Native Reserve, and that portion of the district lying south of the farms Mhungura, Nyagadzi, Umzelzewe, Hermit, Sable Home, Elizabethville, Sannie's Rust and Jersey. Ports of exit—Mutema Reserve, Cragmour and Holland.
7. The Sabi and Narira Reserves, in the native district of Charter Ports of exit—Runda Farm, Nyamakungarubghe, Mazwarmaka, Madzirire, Namasanga, Chigabagaba.

8. The native district of Chibi, excluding the British South African Ranches, Matibi Reserve No. 1 and that portion of the Chibi native district lying north of the Lundi River. Port of exit—Gwhai Dip Tank.

9. That portion of the native district of Gwanda lying east of the blocks Jopempi, Elwes and Elwes Extension, excluding Deti Rest Camp and that portion of the British South Africa Company's Ranches lying in this area. Ports of exit—Deti Rest Camp and Liebig's Drift.

10. That portion of the native district of Lomagundi bounded by a line drawn from the junction of the Sanyati and Zambesi Rivers, up the Sanyati River to its junction with the Tengwe River; thence up the latter to its headwaters; thence in a direct line to the headwaters of the Mlechu River; thence down the latter to its junction with the Angwe River; thence down the latter to the escarpment; thence eastwards along the escarpment to the Utete River; thence down the latter to the Msengezi River; thence down the latter to the Anglo-Portuguese border; thence westward and northward along the border to where it cuts the Zambesi River; thence up the latter to its junction with the Sanyati River. Ports of exit—Magondi, Nassau Estates, Uvungwe and Sipolilo.

11. The native district of Darwm. Port of exit—Arcadia Farm.

12. In the native district of Mtoko, an area bounded by a line drawn from the Mtoko Reserve beacon on Mount Nyachinonga to the north-western beacon of Lawley's Concession; thence along the northern boundary of the latter to the Ruenya River; thence down this river to the Anglo-Portuguese boundary, and along the latter to the Mazoe River; thence up this river to its junction with the Nyaderi River, and up the latter to its junction with the Nyamkaranga River; thence up the latter to a point nearest the Tsutswe range of mountains, and along the crest of the latter and the Nyarugwenje range of mountains to the point first named. Ports of exit—Makaha and Rukan.

No movement of cattle shall be permitted from any such area exempted, except by port of exit, as provided by section 9 of the said Ordinance, and then only after being dipped at such port of exit four times at intervals of not less than five days or more than seven days.

No. 603 of 1921.]

[23rd December, 1921

"IMPORTATION OF PLANTS REGULATION ORDINANCE, 1904."

IT is hereby notified that His Honour the Administrator has been pleased, under and by virtue of the powers conferred upon him by the "Importation of Plants Regulation Ordinance, 1904," to prohibit, from and after the date of this notice, the introduction into Southern Rhodesia from any place overseas of lucerne seed and lucerne plants or any portion thereof, except under the authority of a permit, the granting of which shall be at the discretion of the Director of Agriculture, who may attach such conditions to the importation as he may deem desirable.

Any person guilty of a contravention of the provisions of this regulation or of any of the conditions imposed upon any permit granted in terms thereof shall be liable to a fine not exceeding £10.

No. 602 of 1921.]

[23rd December, 1921.

"ANIMALS DISEASES ORDINANCE, 1904."

IT is hereby notified that, under and by virtue of the powers vested in him by the "Animals Diseases Ordinance, 1904," as amended by the

"Animals Diseases Amendment Ordinance, 1918." His Honour the Administrator has been pleased to amend Government Notice No. 21 of 1917 by the cancellation of sections 9, 10 and 11 relating to transport cattle and the substitution of the following sections in lieu thereof:—

"9. The movement of cattle for draught purposes may be permitted under the provisions of sections 5 and 6 hereof only within the boundaries of areas fixed for that purpose from time to time by the Administrator: such movements may be authorised over defined roads for specified periods. Provided that the Controller of Stock or the Chief Inspector may grant special permission in writing for the movement of such cattle under such conditions as he may deem necessary to impose.

10. All cattle in use for draught purposes, except within the areas defined by section 3, sub-sections (a), (b) and (c), shall be clearly and distinctly branded with the registered brand of the owner.

11. All wagons or other vehicles drawn by cattle, in terms of the preceding sections, shall have the owner's name and address legibly and permanently inscribed on the right side thereof "

Nos. 596 and 10.]

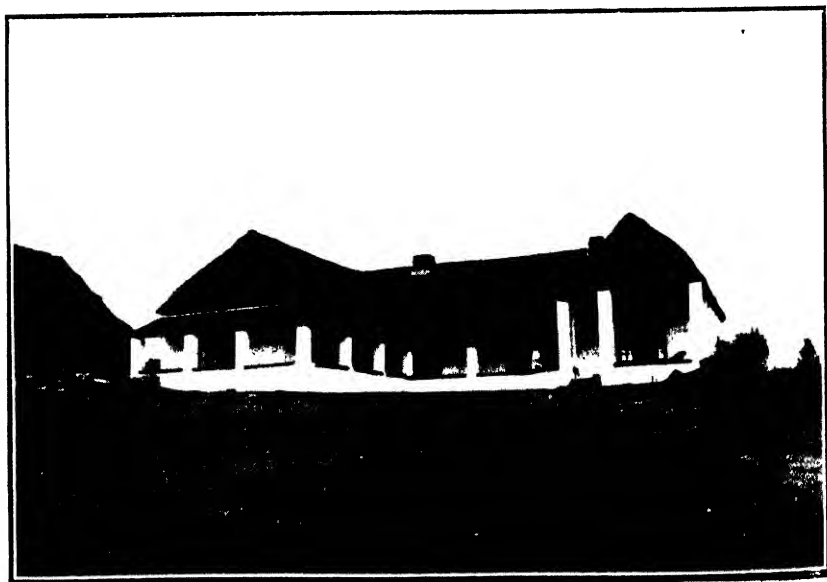
[16th December, 1921, and 6th January, 1922.

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.

IT is hereby notified that the following applications have been made for authority to use water :—

Name of applicant.	Farm.	Native district of	From what river.	Nature of application.	Purpose for which required	Period for objection.
H. H. Smetham ...	Fairview ...	Untali ...	Sambi ...	To divert public water	To irrigate 50 acres	Three months from 16/12/21 do.
F. A. Readman ...	Campsie Glen	Victoria ...	Chitindi ...	do.	To irrigate 80 acres	
Mrs. K. Blaikie Williams (by consent of the B.S.A. Company)	Hartleyton Estate	Lomagundi	Muneni ...	To abstract public water	To irrigate 40 acres	Three months from 6/1/22
J. B. McNeill ...	Sub-div. J of farm Graves-end	Bubi ...	Bumani ...	do.	To irrigate 30 acres	do.

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within the period above specified from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of these applications, together with a full statement of the grounds for such objections.



Pisé de terre house at Mr. G. C. Kilburn's farm, Wensleydale, Macheke.



THE RHODESIA
Agricultural Journal.

Issued by the Department of Agriculture.

PUBLISHED BI-MONTHLY.

Subscription : 5/- per annum.

VOL. XIX.]

APRIL, 1922.

[No. 2.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

A Pisé de Terre House.—We reproduce on the opposite page two illustrations of a house built in pisé de terre by Mr. G. C. Kilburn, at Wensleydale, Macheke. The house consists of a sitting room (opening on to the terrace and deep verandah), three bedrooms, bathroom, dining room, office and linen room. The house, with the exception of the thatching, internal plastering and the carpentering work, was built entirely by Mr. Kilburn and his partner with unskilled labour. The bay window and the pillars are built of brick. These were originally built in pisé, but being considered unsafe, were altered. All the interior is done with Hall's distemper. The whole house is very successful, and a tribute to the energy and enterprise of the builders, who are recent settlers in this country. The foundations

are of brick with cement on top, overlaid with a course of tar, pitch and sand. So far there are no signs of ants. The terrace and verandah are laid with granite, as is also the courtyard between the house and kitchen (on left). The latter is not yet finished, and is to be re-built and thatched during the forthcoming winter. All the walls are heavily reinforced with barbed wire and are constructed of red soil, with a certain amount of sand added. Mr. Kilburn will be pleased to give anyone interested in the construction of this house any information desired. He, however, warns any enthusiast that the building of such an elaborate house in pisé work is not so easy as it may appear. The house is situated on an elevation and commands a magnificent view for some fifty miles.

The Show Season.—At the time of going to press notification has been received that agricultural shows are to be held at Bulawayo on the 30th and 31st May, at Gwelo on the 6th and 7th June, at Rusape on the 23rd and 24th June, at Sinoia on the 7th July, at Umtali on the 29th and 30th June or the 30th and 31st July, and at Salisbury on the 8th, 9th and 10th of August. So far as we are aware, shows will not be held at Victoria or Enkeldoorn this year. We are pleased that a show is to be held at Gwelo after an interval of some years, and we sincerely trust it will be well supported by farmers and achieve the success associated with former shows. The Bulawayo show as usual will primarily be a cattle show, and in spite of the fact that the society's committee have found it necessary to dispense with cash prizes except in a few sections, we feel sure that the show will not suffer from lack of entries. The Bulawayo show is one of the principal cattle shows in the sub-Continent, and it has played an important part in the recognition of Rhodesia as a cattle country *par excellence*. Our wishes are with the society for a successful show.

Grasses of Agricultural Importance in Southern Rhodesia.—We would draw particular attention to the article which appears in this issue and bearing the above title. The article is in two parts; Part I. is written by Mr. H. G. Mundy, Chief Agriculturist and Botanist, and describes the field characteristics of a number of grasses, indigenous and exotic, which have for some years been under trial at the experiment station, Salisbury. Part II. is compiled by Mr. G. N. Blackshaw and Mr. E. V. Flack, of the Chemistry Branch, and records the results of the analyses of the grasses enumerated in the first part of the article. The subject is thus dealt with from the botanical, agricultural and chemical points of view, and the knowledge now made available will, we think, be of great practical value to the pastoralist and the country in general. As is pointed out in the article, the results are by no means final or conclusive, and much still remains to be learnt regarding the behaviour of the grasses under varying conditions. Sufficient has been done, however, to warrant publication of the results.

obtained and thus enable farmers to experiment on their own behalf with grasses which have already given very promising results and which possess specific value. The most that the experimental work conducted by the Department of Agriculture can do is to indicate the way and so save farmers from working in the dark. The results themselves can never be absolutely conclusive and of far-reaching value to the country as a whole until they are accepted by the farmers and tested under the special conditions which obtain on each individual farm. The grasses referred to in the reports consist almost entirely of African and the more likely of our Rhodesian native species, for the better known and valuable grasses of other parts of the world have generally failed under our conditions. The analyses show that some of our native grasses possess a high feeding value, and if successfully propagated they would undoubtedly solve many of the difficulties encountered by stock owners.

It is pleasing to record that quite a number of farmers responded to the invitation to send to the Department for trial grasses of special merit, and that this very important work of investigation has been materially assisted thereby. We would emphasise that there are undoubtedly many other grasses, possibly in remote districts, possessing valuable properties which are not yet known or their importance realised. The progress of this work, of which the present reports are the forerunner, can still, therefore, be greatly assisted and hastened by farmers continuing to forward to the Department specimens and roots of any grass which they do not think has already been dealt with and which seems to possess valuable characteristics. We feel sure that the reports, which will be reprinted in bulletin form, will be read with great interest.

The Maize Trade.—A recent bulletin issued by the International Institute of Agriculture, Rome, contains some interesting statistics of the world's maize trade. These figures show that Great Britain is by far the largest importer of maize, with a total of 19,227,590 bags of 200 lbs. during eleven months of 1921. Of this total 304,864 bags were re-exported. The Netherlands imported 8,307,813 bags during the same period, Denmark 4,717,913 bags, Canada 2,985,219 bags, Czecho-Slovakia 2,057,187 bags, and Sweden 1,162,266 bags. Italy, although she grew 26,455,550 bags in 1921, imported 4,139,347 bags during the first nine months of that year; Austria imported 1,585,127 bags, and Spain for eight months of 1921 1,575,777 bags. Statistics are not given of the imports of France and Germany during 1921, but for ten months of 1920 the figures were 4,535,478 and 2,365,390 bags respectively.

During the period 1st January to 30th November, 1921, the United States of America exported 33,267,801 bags; for the corresponding period of 1920 only 4,121,750 bags were exported. Argentina during eleven months of 1921 exported 28,571,949 bags, which is about half the total crop. Roumania is the next largest exporter of maize, with

a total during the period mentioned of 8,200,259 bags. In 1920 Roumania grew 52,210,450 bags of maize. The Serbia-cr-Slov State in nine months of 1921 exported 3,617,128 bags, and the Union of South Africa during the same period 2,905,404 bags.

For the purpose of comparison it is interesting to note that during the period 1909-10 to 1913-14 the United Kingdom imported a yearly average of 22,568,560 bags of maize, Germany 8,950,760 bags, and France 5,545,680 bags. These figures are taken from the United States Department of Agriculture Year-Book, and from the same source we see that the average yearly export from the United States during the years quoted above was 10,996,880 bags. The 1921 maize crop was less than that of 1920, and an explanation of the sudden leap to 33,267,801 bags may be that with the slump in the prices of stock it was found more profitable in certain parts of the country to export maize than to feed it to stock.

The Poultry Industry.—A meeting of those interested in the poultry industry will be held in Salisbury at 10 a.m. on the 19th April for the purpose of discussing the advisability of forming a Rhodesia Egg Circle. The Director of Agriculture will probably preside, and the Poultry Expert will explain the principles of the proposed organisation. It is to be hoped that poultry men will be present in large force, for the occasion is one of the greatest importance to the industry. The necessity for organising the egg output of this country was set out by the Poultry Expert in the December issue of this journal, since when the matter has been well ventilated in the local Press. The way has been cleared and the time is ripe for a full discussion of the matter, with a view to the adoption of a concrete scheme. We believe that organisation is imperative if the poultry industry of this country is to expand and fulfil its early promise. It has been proved beyond question that the conditions in this country are particularly favourable to the rearing of poultry of highly productive capacity, and there is no reason why a large and profitable industry should not be built up. As to whether we have reached the stage when we can export eggs in large quantities remains to be seen, but it is very necessary that the matter should be fully investigated. The egg trade of the Belgian Congo is worth £10,000 a year, which is met almost entirely by eggs supplied from the Union. It is encouraging to note that some 4,000 dozen eggs were sent to the Congo from this Territory last year and that these found a ready sale at remunerative prices. It is useless, however, to endeavour to create an export trade without proper organisation. Apart from the matter of export, the present method of distributing eggs in this country is unsatisfactory both to the producer and the consumer, while the quality of many of the eggs sold leaves much to be desired. The amount charged for eggs is also subject to wide and frequent fluctuation, and it is desirable that there should be a uniform price, fair to the producer and the consumer. It will be the function of the Egg Circle to remedy these anomalies.

Rhodesia as a Ranching Country.—Another tribute to the value of Rhodesia as a ranching country was paid by Mr. W. G. C. Britten, Secretary of the English Hereford Cattle Breeders' Society, in an interview which was reported in a recent issue of *The Farmers' Weekly*. Mr. Britten, who has been touring the world in the interests of the Hereford breed, spent some little time in Southern Rhodesia inspecting the herds of prominent breeders, and whilst here travelled over a large area of the Territory. He expresses himself thus: "I must say right at the outset that I am particularly struck with the value of Rhodesia as a ranching country." . . . Again: "I think that Rhodesia is undoubtedly a ranching country of the highest order. It possesses all the requirements—an abundance of first-class grasses, plenty of water, and a climate second to none in the world. It has plenty of cheap labour and the tick trouble is being overcome. Why should Rhodesia not produce, and on a large scale, as cheap beef as any other country in the world?"

The views expressed by Mr. Britten coincide with those of many other visitors to the country qualified to speak with authority on the subject. Coming at this time when the country is passing through a period of depression common to all stock raising countries of the world, it should hearten those whose interests are bound up in the development of the cattle industry of Rhodesia. Mr. Britten tenders some excellent advice by emphasising the necessity for (1) good management, and (2) the continued use in each generation of the highest class of sire obtainable. Our readers will appreciate the wisdom of this advice, the application of which is essential for the successful production of beef under our changing conditions.

Agricultural Experiments.—At the meeting of the Maize Association, held in Salisbury on the 8th March, Mr. H. B. Christian brought forward a resolution to the effect that a committee should be appointed to discuss with the officials of the Agricultural Department the carrying out of definite co-operative experiments extending over a number of years and dealing with certain specified problems of soil management. Mr. Christian pointed out that although the results obtained on the Salisbury experiment station and the Gwebi experiment farm were especially interesting and valuable and afforded information upon the general lines which should be adopted, yet soil conditions in different parts of the country varied greatly. He said that if the lessons learnt on the experiment station were to be rendered of the fullest possible use to the country these must be repeated on somewhat similar lines on individual farms in the various districts. They could never hope to have experiment stations in each district, and he thought that the farmers themselves should undertake to carry out these experiments without any assistance from Government other than that of advice in the formulating of the experiments.

Mr. Christian's proposal met with strong support, and it has the fullest sympathy of the Agricultural Department.

It is understood that the line which these experiments will take will be such as green manuring trials, the use of lime, the use of artificial fertilisers, and so forth. It is intended that the experiments shall be carefully carried out over a number of years and that at the end of each season the results of each trial shall be forwarded to the Department of Agriculture, by whom they will be compiled and published in this journal.

Milk Records.—As will be seen from the returns published elsewhere in this issue, more farmers are beginning to realise the value of milk recording. Although these fresh entries are very encouraging, there is still scope for a greater measure of support than has up to the present been accorded to this scheme. A recent issue of *Hoard's Dairyman* contains the following pithy paragraph: "The fellow who thinks he hasn't got time to weigh and test each cow's milk is just the kind of cuss who would be too sleepy to answer when Gabriel blows his trumpet, and the consequences are about the same in both cases. If that is all the business he has about him he might as well be lost in this world as well as in the next."

Besides weighing the milk, it is to be hoped that the use of the Babcock Tester will become more common in Rhodesia, as the butter fat content of the milk is its most important constituent from a commercial standpoint. Milk recording has proved that the propensity to give high butter fat yields runs in families. By the adoption of testing and selection the butter fat content of the milk given by the Danish dairy cow, taken on the whole, has been raised from 3.4 per cent. to 3.83 per cent., while the average yield of milk per cow per annum has been increased from 699 gallons to 934 gallons. This raising of the standard of production has been the means by which millions of pounds have been saved to the Danish dairy farmers, as it costs just as much to keep a bad cow as it does to keep a good one.

We again urge farmers in their own interests to support the scheme of milk recording which the Dairy Expert is endeavouring to popularise, for we feel sure that only by the keeping of such records will a successful dairying industry be built up in this country.

The Fruit Growing Industry.—Since our last issue appeared, in which we outlined the functions of the Fruit Growers' Exchange of South Africa, Ltd., a meeting of fruit growers has been held in Salisbury and a co-operative association formed with the object of affiliating with the Exchange. This action is necessary, for the laws of the Union of South Africa prohibit the Exchange from dealing with individual growers. The official title of the association is to be the Rhodesian Co-operative Fruit Growers' Association, Ltd., and a committee of five was appointed to draft the necessary memorandum

and articles of association for registration purposes. We are pleased that Rhodesia is to be associated with this movement, which aims by co-operative endeavour to further the interests of the fruit growers of South Africa. There are many ways in which the Exchange can be of use. At the present time the most urgent need is the provision of shipping space, which proved so inadequate last season. The Exchange is tackling this question, and there is a good prospect of satisfactory arrangements being made for transporting the coming crop. A number of pertinent questions were asked at the meeting held in Salisbury, and amongst these was the matter of marketing the fruit. It was explained that existing arrangements would not be interfered with and that members of the proposed association would be free to employ whatever agent they chose to despatch their fruit to the overseas markets. As a matter of fact, the Exchange and the shipping agents will work in close touch with each other. At a later date the Exchange will probably undertake the marketing of members' fruit in the same way as does the California Fruit Growers' Exchange, but that time is not yet. The conditions of the fruit exporting trade have been described as chaotic, and the time is indeed ripe for the formation of a central organisation to take charge of the industry. The Exchange can be a power for good, and we trust that it will receive the support of all fruit growers. We understand that more than a sufficient number of associations have been formed to enable the Exchange to be registered, and that this will shortly take place.

We publish elsewhere in this issue the first part of an article written by Mr. A. G. Turner, dealing with the growing of citrus fruits in Rhodesia. The subject was previously dealt with by the same author in a series of articles which appeared in this journal in December, 1914, and three subsequent numbers. The present article revises and brings up to date all that has previously been written on the subject, and will be of great assistance to those who are growing or contemplate the growing of oranges. Mr. Turner has been in Rhodesia since 1914, previous to when he had a lengthy experience in all branches of fruit growing in Cape Colony, the Transvaal and California. His views then carry weight. Mr. Turner holds the opinion that there is a bright future for citrus growing in Rhodesia, and in substantiation of this points to our cheap land, water, labour and transport. Further, to our freedom from damaging frosts such as occur in California. Mr. Turner gives the approximate average prices realised for Rhodesian oranges sold in England last year, and this works out at 10s. per box on the farm. On the basis of only one box per tree, this gives a profit of £40 per acre, but, of course, after five years a tree should produce more than this quantity of fruit.

There are comparatively limited areas in the world where good commercial oranges can be grown, and, providing the fruit is of good quality, there never should be any difficulty in finding profitable markets. The fact that South African oranges can be placed on the English market during the summer season is most important, and the demand being created, it only remains to meet it. Mr. Turner is emphatic that it is absolutely necessary to provide irrigation in

this country when growing oranges, and this is a point which should be well noted. The next part of Mr. Turner's article deals comprehensively with the matter of irrigation, and will be found of great practical value.

The Tobacco Slug.—The *Government Gazette* of 17th February, 1922, contains a notice prohibiting the importation into Southern Rhodesia of tobacco leaf from the Union of South Africa except under the authority of the Director of Agriculture, who may attach such conditions as he may deem desirable. The reason for this action is the prevalence in the Union of tobacco slug (*Lema Bilienata*, Germar), which, first recorded in Natal, has invaded the other provinces of the Union in more or less serious form. The tobacco slug is capable of doing an immense amount of harm and is regarded as one of the worst pests of tobacco in South Africa. The adult of the tobacco slug is a beetle about a quarter of an inch long and half as wide, coloured black, with two longitudinal light yellow stripes. The female lays her eggs in clumps of fifteen to forty on the lower surface of the tobacco leaf. These eggs hatch in a few days into tiny grubs or slugs, which, when full grown, are about a quarter of an inch long, dirty white in colour and covered over the back with slime. The change to a beetle takes place in a small, dirt-covered cell in the ground.

The pest has not so far been detected in this Territory, and it is hoped that the action taken will prevent its introduction.

The Ground Nut.—We publish in this issue an article written by Mr. C. Mainwaring, Agriculturist, on the growing of ground nuts, which we think will be of great assistance to all those who are growing or contemplate planting this crop. A previous article on the same subject written by the Chief Agriculturist appeared in this journal for August, 1914, but since then various cultural and other experiments have been carried out on the experiment stations and valuable knowledge has been acquired as to the treatment likely to give the best results. Mr. Mainwaring embodies all this information in his article and places before farmers the sum total of the Department's experience with and knowledge of this crop.

The statistics which we published in our last issue show that last season 4,414 acres were planted to ground nuts in Southern Rhodesia—almost double the acreage of the previous season. Although this increase is considerable, it does not represent in any way the expansion that is possible in view of the large areas of land suited to the culture of the crop. As Mr. Mainwaring points out, the climatic conditions over the whole of Rhodesia are favourable and the crop seldom suffers from drought, while it is remarkably free from insect pests and disease. With such conditions, the possibilities of the crop are enormous. As

regards markets, there are two oil mills now operating in Salisbury which can take a certain quantity of the nuts grown. It is, however, to export overseas that we must look for our principal markets. The United Kingdom and the Continent of Europe, France in particular, are large users of ground nuts, and there should be no difficulty in placing the product. Everything, of course, depends upon prices, which are subject of fluctuation. Latest British quotations are in the neighbourhood of £15 to £20 per ton. Cost of freight on unshelled nuts and the labour and expense of decorticating the nuts have proved a handicap to the export trade. Particulars of a ground nut press which seems likely to assist in the solving of this difficulty have recently been received by the Department. The nuts in the shells are pressed and baled, it is said, without injury to their quality, and in this form it is claimed are more acceptable to the oil crushers, travel better and cost the same in freight as decorticated or shelled nuts. The plant is not an expensive one, but is not such, it would appear, as could be used on individual farms. Simultaneously a tentative enquiry has been received from Hull for 500 to 1,000 tons of shelled nuts of similar quality to a sample recently sent home and which was shelled by a local implement firm with a hand sheller, in the presence of officers of this Department.

The ground nut, or peanut as it is commonly called in the United States of America, is a crop of very great importance in that country. For instance, in 1919 33,925,000 bushels were grown, and this output was considerably smaller than those of the two previous seasons. Amongst other uses the nuts are employed very largely for the fattening of pigs in conjunction with other foods, and a recent issue of *The Peanut Promoter* gives some interesting particulars of certain feeding experiments. Thus:—

“Many years ago, Duggar, at the Alabama Station, obtained a pound of gain on small pigs in a dry lot from 28 pounds of unshelled peanuts. Later experiments, at the same station, by Templeton obtained a pound of gain as an average of two trials from 1.84 pounds of peanuts plus the vines and other forage grazed by the pigs. These were also small pigs weighing at the start from 63 to 75 pounds each.

“In these tests a yield of 39½ bushels per acre produced 668 pounds of gain and a yield of 30 bushels 416 pounds of gain. As indicated, the evidence we have is not sufficient on which to base positive conclusions, but it would seem that peanuts yielding 35 bushels per acre may be expected to produce 400 pounds or more of gain on hogs weighing around 75 to 100 pounds each. It seems at least perfectly safe from the data on hand to conclude that when hogs weighing 100 pounds each are fed some corn while grazing peanuts, an acre of peanuts producing 1,000 pounds of nuts may be credited with 400 pounds of gain or increase in weight of the pigs. In the two Alabama tests the average was 542 pounds gain per acre. If we allow 400 pounds gain from 1,000 pounds of peanuts, this gives a pound of gain for 2½ pounds of peanuts, which is more than was required in the tests cited above at the Alabama experiment station.”

Apart from the value of the nuts, the crop is profitable for its hay, and, in the opinion of *The Peanut Promoter*, the Spanish variety is best suited for this purpose. In this connection it is stated: "The Spanish peanut, when fed with vines and pods together, is one of the best feeds for horses and mules, for brood mares and for colts. This kind of hay is one of the best known milk-forcing feeds for dairy cows when big yields are wanted. Beyond a doubt the peanut is the coming crop for the hog farmer. An acre of peanuts will produce as much pork as three acres of average corn. No trouble about gathering the crop. Just mow the tops for hay and let the hogs gather the nuts for themselves."

The Locust Pest.—In view of the present prevalence of locusts in the South African Union, including the Western Transvaal, and the possibility of an invasion of this Territory by the pest, attention is called to the provisions of the "Locusts Destruction Ordinance, 1918," under which all occupiers of land are under the obligation of reporting promptly to the nearest magistrate or police station whenever locusts deposit eggs or hoppers hatch out on land for which they are responsible.

The Ordinance also provides for the destruction by the occupier of any hoppers which hatch out, material for this purpose being furnished by the Department of Agriculture on being notified of the occurrence. It is further suggested that, although not compulsory under the Ordinance, any person observing flying swarms should, in the public interest, report the matter as above, stating locality of observation, direction of flight and giving a rough indication of the size of the swarm.

It is perhaps desirable to state that the above warning is of a purely precautionary nature, and that the prevalence of locusts in the Transvaal has not in the past necessarily been followed by an outbreak in this Territory. If such an undesirable event occurs, the southern and western portions of the Territory are likely to be the first affected.

The Dairying Industry.—The figures showing the production of dairy produce during the year 1921 are very satisfactory. The amount of creamery butter manufactured in Southern Rhodesia during the year under review was 604,811 lbs., as against 381,000 lbs. in 1920 and 161,000 lbs. in 1919. Butter exported amounted to 421,815 lbs., valued at £47,165, as against 205,098 lbs., valued at £29,312, in 1920, and 126,552 lbs., valued at £12,536, in 1919. We believe that the quality of the butter showed an improvement, although it still leaves a good deal to be desired if we are to compete on equal terms with New Zealand and Australia in the overseas markets. No doubt the present drought is having a depressing effect upon production, but farmers should always have one or two silo pits

full to meet a period of shortage such as is likely to obtain in the near future.

The cheese position is not so satisfactory as the butter position. Except in one or two districts milk is not produced in sufficient quantities to warrant the erection of a cheese factory capable of turning out more than 100 lbs. a day, but there is no reason why those farmers who are getting from ten to thirty gallons of milk per day should not be able to manufacture cheese which should compete successfully with the imported article. It is suggested that only cheddar cheese be made in the flush season. Gouda cheese is certainly easier to make, but the resulting product is frequently of no commercial value, and often waste of good raw material and of time is entailed by the manufacture of this particular variety of cheese. Cheddar cheese requires no expensive or intricate plant; in fact some farmers are making excellent cheese with no more expenses than the purchase of a mould, costing about £1, a thermometer, rennet and colouring. A wagon jack is used as a press, and two baths, one fitting inside the other, form the vat. It is hoped that next season more farmers will take up this lucrative form of disposing of their dairy produce.

Importation of Citrus Trees.—We publish at the end of this journal Government Notice No. 103, which modifies the restrictions regarding the importation into Southern Rhodesia of citrus trees from the Union of South Africa. Citrus trees grown by registered nurserymen in the Cape and Natal provinces may now be admitted into this Territory under the authority of a permit granted at the discretion of the Director of Agriculture, Salisbury, who may attach such conditions as he may deem desirable. It should be noted that the restrictions are relaxed in so far as Cape Colony and Natal only are concerned, and in regard to citrus trees alone. Therefore the importation of fruit, seed, cuttings, etc., is still prohibited from any part of the Union.

Northern Rhodesia Importation Regulations.—The regulations governing the importation into Northern Rhodesia of forage, straw, etc., used as packing, have been amended to the extent that it is not now necessary to obtain a permit for such importation. It is, however, required that goods so packed shall be accompanied by a certificate from a veterinary officer that there has been no East Coast Fever in the territory or district from which the packing is procured for the past five years. Further, there must be sent a declaration signed by the consignor to the effect that the packing has been disinfected by fumigation for a period of at least eighteen hours.

Grasses of Agricultural Importance in Southern Rhodesia.

THEIR COMPOSITION AND FEEDING VALUE.

PART I.—DESCRIPTION AND FIELD CHARACTERISTICS.

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist.

Some aspects of this subject have already been discussed in an article entitled, "The Improvement of Rhodesian Pastures," published in the issue of this Journal for April, 1920, and subsequently reprinted as Bulletin No. 351. Reference was there made to investigations carried out during the previous nine years with the object of introducing grasses which, by their hardiness and drought and frost-resisting qualities, would provide improved dry-land grazing during the winter months. It was pointed out that with very few exceptions the better known and more valuable grasses of other parts of the world had failed entirely to meet these demands, but that similar experiments conducted with African, and especially with the more likely of our native Rhodesian species had given very encouraging results. At the same time the attention of stock owners and ranchers was drawn to the need for studying their pastures more carefully and for ascertaining the relative values of the different grasses present in their grazing lands. To assist in this work, all interested in the subject were invited to forward to the Department for trial roots or seeds of any grass which they regarded as of special merit.

It is satisfactory to record that quite a number of likely grasses have been obtained in this manner. An even larger number have been collected by various officers of this branch and have been transferred to the Salisbury experiment station, with the result that there are there to-day under observation and trial:—

- 55 native Rhodesian species or sub-species;
- 10 African species (not known to be native to Rhodesia);
- 10 exotics to Africa; survivors of exhaustive trials or recent introductions whose value has not yet been determined.

Though the isolation of native species was commenced as early as 1913, it did not become fully apparent until several years later that little success could be hoped for from exotics, and that the surest road to success lay through the study and systematic trying-out of the most

promising of the native varieties. This line of investigation has been concentrated upon for the last two-and-a-half years, and, results at the end of the first dry season proving so encouraging, it was decided to invite the co-operation of the chemical branch in order that the feeding value of the grasses might be studied at the same time as their palatability, drought resistance and other field characteristics. The report forming the second part of this article records the results of the grass analyses thus far carried out, and in order that this information may have as wide a practical interest as possible, brief notes are here given on the economic value of the grasses dealt with in the Chemists' report. It cannot be claimed that these records are final or conclusive. Much still remains to be learnt regarding individual peculiarities, especially in respect of permanency, longevity and adaptability to different soils.

As a result of the trials already referred to, it may, however, safely be said that for the improvement of our unirrigated, and possibly of our irrigated pastures also, we must look primarily to native or at least South African grasses. Rhodesian climatic conditions are peculiar, and the indigenous grasses have in process of time adapted themselves to these conditions. The feeding value of quite a number is all that can be desired; many can be established with comparative ease, and there is no longer any doubt that pure pastures of the best of these, especially if paddocked and fed off in rotation, will provide very superior grazing and will carry a very much heavier stocking per acre than will the natural veld.

Mixed pastures including several different kinds of grasses, provided all are good, are probably superior to pure pastures, but before advice regarding these can be offered, the investigations must be carried further, and it must be ascertained which of the varieties best blend together and tolerate each other. *Meanwhile pure stands of any of the best species referred to in these notes can be relied upon to well repay the labour entailed in laying them down.*

Present records refer mainly to these grasses when grown on red soil in Mashonaland. Their behaviour on black soils will probably be even more satisfactory, but on sandy soils their relative merits are yet to be demonstrated.

To give any concise description of each grass which will enable it to readily be recognised in the field is not easy. Students of botany must rely for identification upon the botanical name, and for the farmer and layman it is hoped that, the majority of the grasses being comparatively common, the very general description given, together with the illustration, will prove sufficient. The identity of all species referred to in this report has been established or confirmed by the Director of the Royal Botanical Gardens, Kew.

INDIGENOUS (Native Rhodesian) GRASSES.

Rhodesian Tussock Grass (*Setaria Lindenberghiana*, Stapf.).—This grass in its natural habitat is seldom found except on the tops and slopes of rocky kopjes. It can be recognised by its rather harsh,

deeply corrugated leaves, which somewhat resemble those of buffalo grass, but are bluish green in colour, less rigid, much narrower, seldom exceeding one inch in width, and gradually tapering to a sharp point. Plate No. 1 shows the appearance of Rhodesian tussock grass when fully grown. It differs considerably from the *Setaria Lindenberghiana* described by Medley Wood ("Natal Plants," Vol. II.), and also it is believed from the type specimens in the Union Herbaria. Of this Rhodesian type there are two distinct and easily distinguishable forms, in one of which the leaves are nodding and in the other erect. Both apparently, however, are of equal economic value.

Tussock grass grows in a dense, leafy, fine-stemmed, upright, rapidly-stooling clump which may reach a maximum height of 3 to 3½ ft. One five-year-old stool selected at random was found to have produced as many as 700 leafy stems. It is a shy seeder, but transplants very easily by sub-division of the roots, and though its appearance is not at first prepossessing, both cattle and sheep are extremely fond of it. An indication of the vigour and bulk of leaf growth produced is afforded by the fact that a small plot of fully grown plants cut and weighed 23rd March, 1921, gave a yield of 34,270 lbs. of green fodder per acre. By the following June the aftermath had reached a height of 12 ins. Throughout the five years that Rhodesian tussock grass has been under trial it has easily maintained itself on the land, and has shown no appreciable loss of vigour. It is one of the least affected by frost and dry winter conditions, and when fed off continues to make strong growth right through the winter months. Naturally this winter growth is not very vigorous, but usually is such as to permit of its being grazed every six weeks or two months. The mature grass if allowed naturally to dry off is also palatable, since plants in this condition have been readily grazed to the ground in mid winter both by cattle and sheep which were in good condition and were free to graze on whichever grasses they most preferred.

Rhodesian tussock grass is undoubtedly a most valuable pasture grass, and for dry lands is probably pre-eminent. It possesses only two disadvantages, namely, that of not seeding very freely and being a tussock rather than a couch-like or running grass.

Penhalonga Grass.—Plate No. 7.—This grass was first collected in the Penhalonga hills on the eastern border of the Territory. It has never yet flowered on the experimental plots, and as flowering specimens have not been procurable, it has not been identified botanically. It is a rather coarse, stalky, semi-erect, broad-leaved grass, spreading by means of the stems which remain on the ground, rooting at the nodes. The growth of Penhalonga grass shown in the illustration, and which yielded fifteen tons of green fodder per acre, has not been equalled since its first season, and it seems to be a species which, as might be expected, makes a heavy demand on the land. It is easily established by root division, and grows rapidly. Cattle and sheep are exceptionally fond of it, especially when young, and will feed on it in preference to most other grasses. When old and mature the stems become hard and cane-like, but at this stage it throws out numerous succulent



Plate No. 1 Rhodesian Tussock Grass (*Setaria Lindenbergiana*)



Plate No. 2 Buffalo Grass (*Setaria sulcata*).



Plate No. 3 Swamp Couch Grass (*Hammarthium paniculata*)

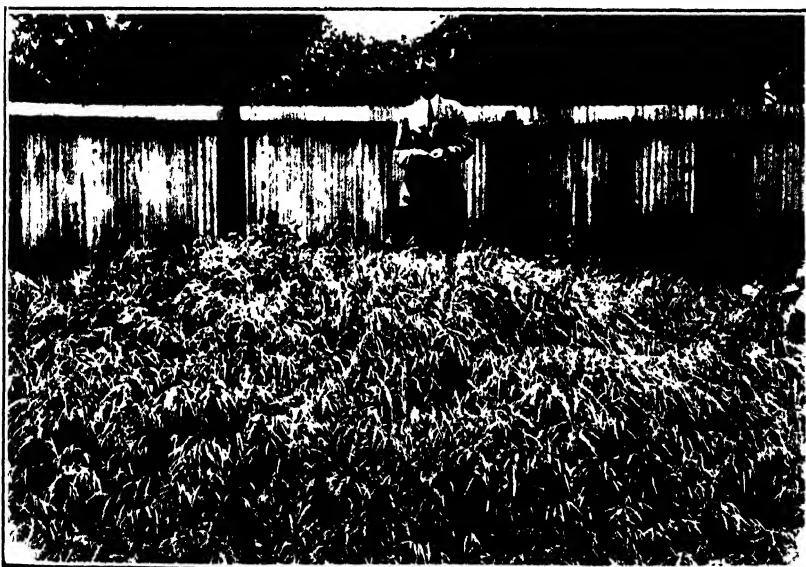


Plate No. 4. South African Star Grass (*Cynodon plectostachyum*)

side shoots which provide early and palatable spring grazing. Penhalonga is not as vigorous a winter grower as tussock grass, and is more sensitive to frost. Very promising results with it have been obtained on the B.S.A. Co.'s Mazoe Citrus Estate, and also are reported by Mr. H. B. Christian, of Ewanrigg, Enterprise district.

False Paspalum (*Brachiaria brizantha*, Stapf.).—There are two types of this grass, both strong-growing, leafy, bunch varieties. One is known as broad leaved and the other as the fine leaved false paspalum. When the native and exotic paspalums were not so well known, specimens of these grasses were frequently sent in by correspondents who thought them true paspalums. In general appearance there is considerable resemblance, but the leaves of the false paspalum are saw-edged, of a dark green, frequently blotched with dark red or purple, more rigid, and are more upright in growth than those of *paspalum dilatatum*. The seed head is similar, but the "seeds" are generally single ranked on the stalk, and instead of being flattened, are very large, plump and egg-shaped. This grass is often and misleadingly called Rhodesian paspalum.

Somewhat sensitive to frost, false paspalum is a robust, leafy and hardy grazing grass, frequently very noticeable on road sides, hard packed ground, or around the bases of ant-heaps. In the veld, after burning, it makes a strong and early growth, and at this stage the unusual seed head is often very noticeable. If kept grazed it is well liked by cattle, but in its later stages is often attacked by a leaf disease which, withering and drying off the foliage, renders it unpalatable. It is also one of the most liable of our native grasses to ergot. As far as can at present be judged, of the two types, the fine leaved variety is the more valuable, and though both are useful, neither thus far appears to rank amongst the best of the "natives" for permanent pastures.

Swamp Couch Grass (*Hammarthria fasciculata*, Kunth.).—Plate No. 3.—The attention of the writer was first drawn to the value of this grass in 1919 by Captain J. M. Moubray, of Shamva, but previous to that date specimens had been forwarded to Mr. F. Eyles of this Department. Swamp couch, as its name implies, is a coarse couch-like grass which, as far as is known, only occurs naturally on wet, ill-drained soils and on low-lying land adjoining rivers and streams. As its analysis indicates, it is a rather hard, wiry grass, and until well grazed produces comparatively little leaf growth, the stems usually being more in evidence than the leaves. These stems are slightly flattened on both sides, and when growing upright are of a yellowish green colour, often tinted with red or dark purple. The flowering head is at first difficult to detect until the anthers appear, being merely a closely jointed and sharp pointed elongation of the stem.

On very wet land, or if not grazed, swamp couch spreads by surface runners, and also makes a strong, upright growth which may reach a height of 18 to 24 ins. On drier soil, and when grazed, it conforms to the natural habit of a couch, seldom exceeding 8 ins. in height, but forming a very close, dense turf. In ungrazed veld it is not usually in evidence, but can invariably be found gaining possession

of wet pastures which have been heavily stocked. On such land it will in time entirely crowd out all other grasses, and if frosts are not too severe, and it is not fed off too closely, it will remain green throughout the entire year. It is extremely easy to establish by root division, and if planted out in favourable weather very few of the sets will fail to grow. Planted 3 ft. apart each way, in a few months it will entirely cover the ground.

Swamp couch is undoubtedly one of the best, if not the best, grazing grass for black soil or water-logged pastures. It is also giving great promise when transferred to drier red soils, on which it grows freely, and has so far remained green and continued to make a reasonable amount of fresh growth right through the winter.

Fine Guinea Grass (*Panicum maximum*, Jacq.).—Plate No. 5.—There are four very widely differing grasses, namely, Guinea grass, fine Guinea grass, Buffel grass and purple-topped Buffel grass, at present identified under the botanical name of *Panicum maximum*. The only one of these so far analysed is the fine leaved Guinea. This, as is shown in the illustration, is a tall, coarse grass, which in its natural state is only found in isolated clumps in the shade of bushes or rocks. Under cultivation it grows strongly without shade, and, though not quite so upright, resembles a fine edition of Napier fodder, but has the typical spreading flower head of the panicums. It is more upright in growth and finer in the leaf than Guinea grass, and less upright and coarser than the Buffel grasses, which are essentially hay grasses. The Guinea grasses are suitable for green soiling or grazing, and for this purpose are superior to Napier fodder, owing to their finer and more succulent character. They are fairly hardy and long lived, and much liked by stock, but are sensitive to frost, and unless occasionally cultivated and manured, seem likely to soon exhaust the land, and make little growth during the dry season. Fine Guinea grass has yielded 15 tons per acre of green fodder from a single cutting. The dry fodder, either cured or left on the plant, is much relished by all stock, and, as the analysis shows, the feeding value is high.

Buffalo Grass (*Setaria sulcata*, Raddi.).—Plate No. 2.—This grass cannot be confused with any other by reason of its large, broad, coarsely-corrugated leaves, which may be as much as $1\frac{1}{2}$ to 3 ft. long by $1\frac{1}{2}$ to $3\frac{1}{2}$ ins. wide. In its wild state it grows in damp, sheltered and shady places, but has proved extremely hardy when transferred to open, exposed, dry soils, though usually making a rather shorter and more rigid leaf growth. In either its green or dry state all stock are extremely fond of it, and its feeding value is high. It is sensitive to frost, but is still eaten greedily even when frosted. Where the winters are mild it will remain green throughout, or if grazed down will come away rapidly and continuously during the dry months.

Buffalo grass, though a bunch variety, may be regarded as an extremely valuable pasture grass, and one well deserving of being laid down in large areas. It transplants readily by root division, and also volunteers from self-shed seed. This grass is different from the curly grass, also known as Buffalo, in the Victoria district.



Plate No. 5 Fine Guinea Grass (*Panicum maximum*)



Plate No. 6. Kikuyu Grass (*Pennisetum clandestinum*).



Plate No. 7 *Fe-d'longa* Grass three months from root division



Plate No. 8 Upright Paspalum (*Paspalum erectum*)



Plate No. 9 Native Paspalum (*Paspalum scrobiculatum*).

Golden Timothy Grass (*Setaria aurea*, A. Br.) is sometimes called Rhodesian Timothy, and is so well known a grass on all the heavier wet soils in Rhodesia that no description of it is called for. It is also common in many parts of the Union, so that the name "Rhodesian Timothy" is not strictly applicable, and should be discarded. This is one of the grasses which are more prevalent on stocked and cultivated farms than in the untamed veld. On certain soils, "old lands" which have been permitted to revert to veld may naturally become an almost pure stand of Timothy. Though of good feeding value and well liked by all classes of stock, especially mules and horses, Timothy does not provide a very heavy yield of hay or of pasturage, though if taken early, two cuttings of hay in the season can often be secured. From a single cutting of mature growth 11,500 lbs. of green fodder have been taken. The seed head is very frequently attacked by ergot. After being cut, it makes a nice aftermath which continues fairly green into late autumn. During mid winter it is practically dormant, but provides good early spring feed. It may, therefore, be regarded as a dual purpose grass, and in this fact lies its chief value.

Red Rhodes Grass (*Eustachys petrea*, Nees.).—Is very similar to Rhodes grass (*Eustachys gayana*) in appearance, but the foliage is of a more bluish tint, and the flower heads a bright chestnut. In its wild state it is usually found in the vicinity of ant heaps. If growing vigorously, it spreads by means of surface rooting runners, but this character is not very constant. When green, and even after being frosted, it is a favourite with stock, but does not make very vigorous or early spring growth. It seldom attains more than 18 ins. in height, and so is rather short for hay, but cures out well. A useful grass, and well worth encouraging. It is at present uncertain whether it possesses any advantage over Rhodes grass.

Antelope Grass (*Echinochloa pyramidalis*, Hitchc. and Chase.).—This grass was so named, since it was first reported as a valuable fodder from the vicinity of the Antelope Mine, a district of light rainfall. In Mashonaland it commonly occurs in wet, damp situations, and in general appearance is not unlike Japanese millet, though less leafy. On the Salisbury experiment station it has shown no outstanding merit either for hay or pasture. At present it seems to have little claim to popularity, though on account of the first favourable report on it, it perhaps deserves further study.

Tall Couch Grass (*Cynodon Dactylon*, Pers.).—There are certainly two, if not three, native types of common couch, identified under the general botanical name of *Cynodon Dactylon*. All are similar in general appearance, but differ in vigour and habit of growth. Another variety of couch, namely, dwarf hairy couch (*Cynodon incompletus*), is also frequently met with. This latter, as its name implies, is a low growing type with hairy or woolly leaves and stems. It does not withstand frost or drought well, but if frequently watered makes a good lawn. The *Cynodon Dactylons*, on the other hand, are all useful grazing grasses, more particularly, however, for sheep on account of the close, dense sward which they form. In the Redbank area of

Matabeleland these couches almost at once take entire possession of abandoned arable land. In all other districts, however, their ingress is comparatively slow, and while deserving under natural conditions of encouragement, they are not probably worthy of being specially laid down for pasture in preference to other more valuable grasses.

Native Paspalum (*Paspalum scrobiculatum*, Linn.).—Plate No. 9.—This grass is frequently to be found closely associated with swamp couch grass and on the same class of land. Occasionally but rarely it has been found growing naturally on dry red soils. It possesses the distinctive and well-known flower or seed head of a *paspalum*, but the whole plant, and especially the flower head, is of a rather pale whitish green colour. The stalk on which the seeds are arranged is considerably wider than with the other two *paspalums* and the seeds are much more regularly and densely packed on the stalk. The leaves often have a pale or whitish central stripe down the mid rib, and leaves and stems are entirely smooth and free from hairs. It is more upright in growth than *paspalum dilatatum*, less rank and erect than upright *paspalum*. In common with all *paspalums*, the native variety is very subject to ergot. When badly ergotted, stock have apparently no liking for it, and when last winter cattle were turned into a badly infested plot they refused to graze it.

Native *paspalum* is more sensitive to frost than either *paspalum dilatatum* or upright *paspalum*, but is remarkable for its very early spring growth, which appears to persist even when the grass is transferred to dry red soils. When young and succulent, stock feed it readily, and apart from its tendency to ergot, the danger from which can be minimised by proper management, it promises to prove a grass of considerable value. It can be easily established by root division, quickly stools out and covers the land, and when full grown may reach a height of 18 to 28 ins. A full season's growth when cut has yielded 19,950 lbs. of green fodder per acre.

Common Red Top Grass (*Tricholoena rosea*, Ness.) and **Bristle Leaved Red Top** (*Tricholoena setifolia*, Stapf).—These red top grasses, of which there are at least four types in Rhodesia, and which occur on all classes of soil, are well known by reason of the colouring of the flowering heads, which in the early stages are a beautiful rose-pink or red, gradually fading as the seed head matures to a silvery white. The red tops belong to that peculiar group of plants which are comparatively rare in the natural veld, but which rapidly make their appearance as weed grasses as soon as the land is brought under the plough or the veld is cut up by roads or severe soil erosion. Those referred to here are both perennials in Rhodesia, and though not very leafy or luxuriant in growth, would be of considerable agricultural importance as hay grasses were they not so early in flowering. This habit usually precludes their being cut for hay at a time when hay making is possible and they would give a maximum yield, and by the time red top pastures can be mown the grass is usually past its best. As grazing grasses when young, both the above species are well liked by stock, and bristle-leaved red top in particular, which is an

upright bunch variety, should prove a useful dual purpose grass. Both species, the latter again in particular, are good drought resisters and make early spring growth. Bristle-leaved red top is easily distinguishable from the other varieties by reason of its longer and closely curled leaves and by its close crowned, upright, tufted growth.

EXOTIC (not Native Rhodesian) GRASSES.

Kikuyu (*Pennisetum clandestinum*, Stapf.).—Plate No. 6.—This grass is already so well known that no description of it seems called for. It is now five years since it was first introduced to the Salisbury experiment station from the Union. Large numbers of roots in many small parcels have been distributed to all parts of the Territory, and many farmers and others have for several years made a habit of selling roots in large quantities. It is, therefore, safe to say that the grass has been very widely tested.

Kikuyu was first introduced from Kenya Colony, where it is understood to thrive to best advantage in a district which is not usually subject to any very prolonged dry season. Its behaviour in Rhodesia indicates that such are the conditions which best suit it. Judging by reports which have been published, the behaviour of kikuyu in the Union and in Rhodesia respectively is very different. Here, although, if given proper treatment, no difficulty is experienced in getting it well established, except on certain farms where white ants have destroyed it, the growth is apparently very much less luxuriant than in the Union, and except under the shade of trees or on very rich soil, it seldom exceeds 8 to 10 ins. in height. On the Salisbury experiment station on land capable of growing twelve to fifteen bags of maize per acre, and although benefiting by heavy stocking with sheep and cattle for part of the year, it never, even when rested, reaches a height of more than 6 ins.

Good results have been reported from planting kikuyu on the edges of wet sand vleis, and under such conditions, in spite of light frosts, the grass is said to be most valuable and to continue growth throughout the winter. It does not appear at home on heavier wet, black soils or on dry sands. On the experiment station it has not responded to moderate top dressings of either farmyard manure or artificial fertilisers, but it does benefit from heavy dressings of the former. It appears to rapidly exhaust the land for itself though not for following crops, and to quickly become sod-bound. Present evidence indicates that dry land kikuyu pastures cannot usually with advantage be left down for more than three to five years. No difficulty has been experienced in getting rid of the grass if the pasture is ploughed up in the dry season.

On soils where it thrives, kikuyu forms an admirable pasture, especially for sheep, but is sometimes too short to afford much feed for cattle. All stock graze it freely, and even on dry red soils it remains green, and affords excellent grazing until the end of July or even later. After that date, it does not make much further growth

until the next rains. On swamp soils of all kinds swamp couch grass seems superior to kikuyu.

Natal Grass (*Pennisetum unisetum*, Bth.).—This is a fine stemmed, leafy, upright grass introduced two years ago from the Union. So far it has only been tested on the Salisbury experiment station, but there it has done well, and during the rainy season reaches a height of 4 to 4½ ft. It is well liked by stock, and as a dual purpose grass, and particularly as a perennial hay grass, it deserves to be tried more widely. It makes good early spring growth, and the aftermath remains green into late autumn.

African Star Grass (*Cynodon plectostachyum*, Pilg.).—Plate No. 4.—This is similar and is a close relative to our native couch grasses, but reaching as it does a height of 12 to 24 ins., is very much more luxuriant in growth. For its introduction the writer is indebted to the Chief of the Division of Botany, Pretoria, who, in 1920, kindly supplied a few roots. Star grass is the most rapid in growth and spread of any grass under trial. It transplants very freely, and when spaced 3 ft. apart each way very quickly covers the ground. It is moderately but not markedly resistant to drought and frost, and will not, therefore, normally provide succulent mid-winter grazing. It promises, however, to be of great value for forming a sole in mixed pastures, and where good couch pastures for hay and grazing (except winter) are desired star grass can be strongly recommended.

Perennial Canary Grass (*Phalaris bulbosa*).—This is a most attractive grass in appearance, the leaves and stems closely resembling green barley in texture and succulence. It stands high in the table of feeding values, is very little affected by frost, and under suitable conditions may be regarded as a most valuable hay or pasture grass. It requires good land, however, and on dry soils is of no value except during the rainy season. It should prove one of the best grasses for perennial irrigated pastures, and if care is taken in laying it down, there seems no reason why it should not thrive to advantage on moisture-retaining vleis. It is not recommended for high lying dry soils.

Upright Paspalum (*Paspalum virgatum*).—Plate No. 8.—Grows to a height of 3 to 4 ft., and in this respect, being more luxuriant and more easily grazed, has an advantage over *paspalum dilatatum*. It is too coarse for an ideal hay grass, and in common with the other paspalums is very subject to ergot. It thrives best on black soils, but also grows well on dry red loams. It is not a favourite with stock in the rainy season, but is freely grazed during the winter months. To minimise risks from ergot poisoning and to render it as palatable as possible, it should be fenced off in paddocks and be heavily grazed the entire year. Upright paspalum possesses little advantage, if any, over native paspalum, and is not generally so desirable as several of the native grasses.

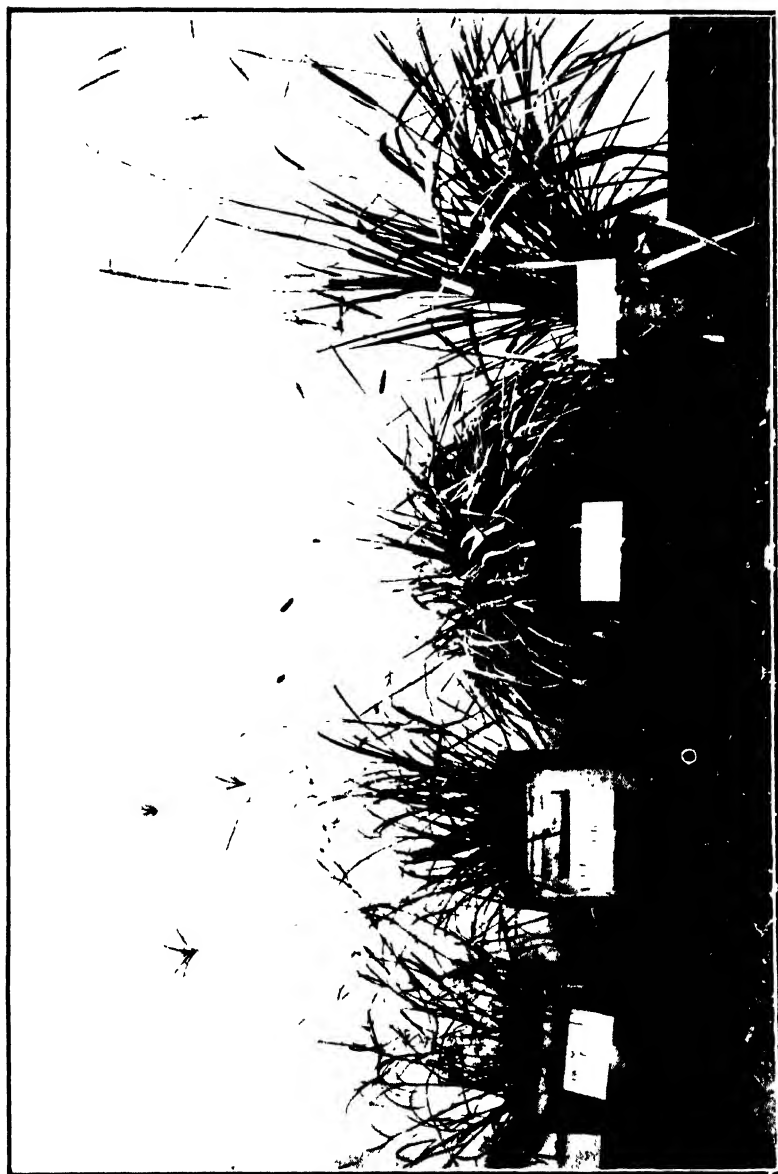
Rhodes Grass (*Eustachys gayana*).—Present results with this grass are not as conclusive as they might be. It is undoubtedly a valuable grass, and one which should do particularly well under irrigation,



From left to right, - Golden Timothy - African Star Grass - Natal Grass - Pennhalonga Grass.



From left to right.—Red Top Grass, Red Rhodes Grass, Buffel Grass, Buffalo Grass.



From left to right.—Swamp Couch, Rhodes Grass, Perennial Canary Grass, False Paspalum.

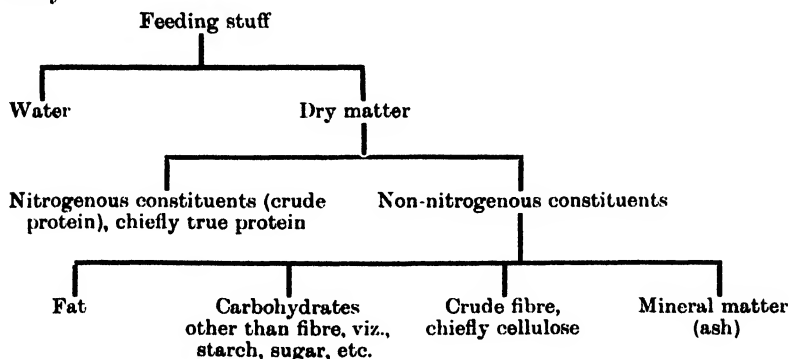
since as an irrigated fodder in the south of India it has proved a phenomenal success, and has outyielded lucerne and all other grasses. It is taller in growth than red Rhodes grass, and spreads more freely by running stems, but even so without irrigation is slow to make a dense stand. The stems are rather hard and coarse. It is a dual purpose grass, but except when irrigated is not in any way remarkable for the vigour of its winter growth.

PART II.—COMPOSITION OF GRASSES.

By G. N. BLACKSHAW, O.B.E., B.Sc., F.I.C., Chief Chemist, and
E. V. FLACK, Chemist.

Analyses of twenty-four grasses grown on epidiorite soil—a red loam—at the agricultural experiment station, Salisbury, have been made at the chemical laboratory of the Department of Agriculture, so that their respective chemical compositions may be considered in conjunction with practical tests to ascertain their relative feeding values.

The constituents of a feeding stuff as determined by the methods of chemical analysis ordinarily practised are shown in the following table, and in order to have a clear understanding of the factors upon which the feeding value in respect of composition is based, the functions in the animal body of the various constituents will first be considered briefly .—



For the bare maintenance of condition, an animal at rest must consume sufficient food to preserve the heat of the body, to provide the energy required for working the heart, and for other vital processes, and to restore the waste of nitrogenous body tissue. Upon the amount of food consumed in excess of that required for maintenance depends the ability of an animal to work, to develop flesh or fat, or to produce other useful products. To develop flesh or to restore the

PARTICULARS OF SAMPLES OF GRASSES.

Name of Grass.		Laboratory No.	Date Sample Taken.	Length of Grass in inches when sample taken.	REMARKS.
Botanical.	Common.				
A.—SAMPLES TAKEN BEFORE FLOWERING.					
<i>Setaria lindenbergiana</i> ...	Rhodesian tussock grass	400G	5-1-21	15—22	Slips planted out season 1919-20; sample representative of growth since grazing down in September, 1920.
<i>Phalaris bulbosa</i> ...	Perennial canary grass	496G	28-4-21	2—9½	Slips planted out season 1919-20; sample representative of season's growth to 28-4-21.
<i>Pennisetum clandestinum</i> ..	Kikuyu ..	494G	29-4-21	7½—22	Slips planted out season 1919-20; sample representative of season's growth to 29-4-21.
— ..	Penhalonga grass	415G	26-1-21	16—30	Slips planted out season 1919-20; sample representative of growth since grazing down in September, 1920.
<i>Brachiaria brizantha</i> ..	False paspalum ... (fine leaved)	480G	29-4-21	9—24	Slips planted out season 1919-20; sample representative of growth since 23-3-21.
<i>Hemarthria fasciculata</i> ...	Swamp couch grass	487G	29-4-21	6—18	Slips planted out January, 1921; sample representative of growth since planting out.
B.—SAMPLES TAKEN AT FLOWERING STAGE.					
<i>Panicum maximum</i> ...	Fine Guinea grass	413G	26-1-21	42—54	Slips planted out season 1919-20; sample representative of growth since grazing down in September, 1920.
<i>Setaria sulcata</i> ...	Buffalo grass ...	486G	28-4-21	10½—26½	Slips planted out February, 1921; sample representative of growth since planting out.
<i>Setaria aurea</i> ...	Golden Timothy ...	482G	29-4-21	7—27	Slips planted out season 1919-20; sample representative of growth since cut down on 23-3-21.
<i>Brachiaria brizantha</i> ...	False paspalum ... (broad leaved)	416G	26-1-21	33—54	Slips planted out season 1919-20; sample representative of growth since grazing down in September, 1920.
<i>Eustachys petraea</i> ...	Red Rhodes grass	414G	26-1-21	24—33	Slips planted out season 1919-20; sample representative of growth since grazing down in September, 1920.

<i>Echinochloa pyramidalis</i> . . .	Antelope grass . . .	417G	26-1-21	31—42	Slips planted out season 1919-20; sample representative of growth since grazing down in September, 1920.
<i>Cynodon plectostachyum</i> . . .	African star grass	491G	28-4-21	15—27½	Slips planted out January, 1921; sample representative of growth since planting out.

C.—SAMPLES TAKEN WHEN FLOWERING AND SEEDING.

<i>Paspalum virgatum</i> . . .	Upright paspalum	489G	29-4-21	22—60	Slips planted out January, 1921; sample representative of growth since planting out.
<i>Paspalum scrobiculatum</i> . . .	Native paspalum	484G	29-4-21	7—19	Slips planted out January, 1921; sample representative of growth since cut down on 26-2-21.
<i>Cynodon dactylon</i> . . .	Tall couch grass . . .	479G	28-4-21	7—22	Slips planted out January, 1921; sample representative of growth since planting out.

PARTICULARS OF SAMPLES OF HAY.

Name of Hay.		Laboratory No.	Date Sample Taken.	Length of Grass in inches when sample taken.	REMARKS.
Botanical.	Common.				
<i>Paspalum scrobiculatum</i> . . .	Native paspalum	485G	29-4-21	11—30	Slips planted out January, 1921; sample representative of growth since planting out.
<i>Pennisetum unisetum</i> . . .	Natal grass	493G	28-4-21	24—51	Slips planted out January, 1921; sample representative of growth since planting out.
<i>Brachiaria brizantha</i> . . .	False paspalum . . (fine leaved)	481G	29-4-21	17—46	Slips planted out season 1919-20; sample representative of season's growth to 29-4-21.
<i>Chloris gayana</i> . . .	Rhodes grass . . .	492G	29-4-21	16—36	Slips planted out January, 1921; sample representative of growth since planting out.
<i>Sttaria aurea</i> . . .	Golden Timothy . . .	483G	28-4-21	19—69	Slips planted out season 1919-20; sample representative of season's growth to 28-4-21.
<i>Tricholena rosea</i> . . .	Common red top . . .	488G	28-4-21	36—48	Sample representative of season's growth to 28-4-21.
<i>Paspalum virgatum</i> . . .	Upright paspalum	490G	29-4-21	24—75	Slips planted out season 1919 20; sample representative of season's growth to 29 4 21.
<i>Tricholena setifolia</i> . . .	Bristle-leaved red	497G	30-4-21	36—42	Sample representative of season's growth to 30-4-21.

COMPOSITION OF GRASSES.

Sample— Laboratory No.	Name.		Condition of sample.	Moisture. %	Fat (ether extract).	Crude protein or albuminoids (N. x 6.25).	Carbo hydrates or nitrogen (by difference).	Crude fibre.	Ash.	Containing true protein (N. x 6.25).	Total nitrogen.	Proteid nitrogen.	Albuminoid ratio on total protein = 1.†	True protein in 1 ton (2,000 lbs.) dry matter.
	Botanical.	Common.												

SAMPLES TAKEN BEFORE FLOWERING.

400G	<i>Setaria lindenbergiana</i> * ...	Rhodesian tussock grass	Green ...	73.10	1.05	4.93	10.14	7.26	3.52	4.23	...	...	...	...
496G	<i>Phalaris bulbosa</i> †	Perennial canary grass	Air-dried	10.66	3.48	16.38	33.69	24.10	11.69	14.06	2.62	2.25	3.6	314
494G	<i>Pennisetum clandestinum</i> †	Kikuyu	Air-dried	75.89	0.78	4.21	10.90	5.74	2.48	3.11	...	...	...	...
			Air-dried	10.51	2.91	15.62	40.45	21.30	9.21	11.66	2.50	1.85	4.8	258
			Green ...	79.57	0.53	2.70	9.35	5.67	2.18	2.30	...	...	...	...
415G	... *	Penhalonga grass	Air-dried	8.40	2.38	12.12	41.91	25.42	9.77	10.31	1.94	1.65	5.6	225
			Green ...	78.10	0.60	2.92	9.82	6.40	2.16	2.24	...	...	...	...
480G	<i>Brachiaria brizantha</i> * ...	False paspalum ... (fine leaved)	Air dried	11.25	2.45	11.81	39.74	25.95	8.77	9.06	1.89	1.45	6.2	204
			Green ...	78.22	0.52	3.07	9.87	5.31	3.01	2.12	...	...	...	...
487G	<i>Hemarthra fasciculata</i> * ...	Swamp couch grass	Air-dried	9.99	2.17	12.69	40.74	21.96	12.45	8.75	2.03	1.40	6.4	184
			Green ...	74.48	0.48	2.04	12.80	8.30	1.80	1.92	...	...	...	...
			Air-dried	8.47	1.73	7.31	46.27	29.77	6.46	6.88	1.17	1.10	9.2	160

SAMPLES TAKEN AT FLOWERING STAGE.

413G	<i>Panicum maximum</i> * ...	Fine Guinea grass (intermediate variety)	Green ...	78.40	0.39	2.63	8.65	7.83	2.10	2.40	...	...	...	...
486G	<i>Setaria sulcata</i> * ...	Buffalo grass	Air-dried	10.04	1.61	10.94	36.04	32.60	8.77	10.00	1.75	1.60	5.4	223
			Green ...	77.48	0.48	3.32	9.44	6.84	2.44	2.50	...	...	...	...
492G	<i>Setaria aurea</i> * ...	Golden Timothy ...	Air-dried	9.81	1.91	13.31	37.80	27.38	9.79	10.00	2.13	1.60	5.5	222
			Green ...	80.48	0.56	3.00	7.83	5.69	2.44	2.13	...	...	...	...
416G	<i>Brachiaria brizantha</i> * ...	False paspalum ... (broad leaved)	Air-dried	8.30	2.62	14.12	36.74	26.73	11.49	10.00	2.26	1.60	5.5	218
			Green ...	76.10	0.51	2.71	9.45	8.73	2.50	2.56	...	...	...	...
			Air-dried	9.48	1.95	10.25	35.79	33.07	9.46	9.69	1.64	1.55	5.6	214

414G	<i>Eustachys petrea</i> *	...	Red Rhodes grass	Green ...	74.40	0.86	2.96	11.38	8.16	2.25	2.61	...	...	...	...	...	...
417G	<i>Echinochloa pyramidalis</i> *	...	Antelope grass	Air-dried	11.25	2.98	10.25	39.46	28.25	7.81	9.06	1.64	1.45	...	...	6.3	204
491G	<i>Cynodon plectostachyum</i> †	...	African star grass	Green ...	78.30	0.44	2.72	8.66	7.85	2.03	2.16	...	...	...	...	6.1	199
				Air-dried	9.22	1.93	11.37	36.24	32.86	8.48	9.06	1.82	1.45	...	...	...	...
				Green	62.93	0.66	3.54	19.75	10.90	2.22	2.31	...	...	...	...	...	125
				Air-dried	9.79	1.60	8.62	48.07	29.52	5.40	5.62	1.38	0.90	...	...	11.4	...

SAMPLES TAKEN WHEN FLOWERING AND SEEDING.

489G	<i>Paspalum virgatum</i> †	...	Upright paspalum	Green ...	74.44	0.74	2.56	11.07	9.20	1.99	2.37	...	...	...	...	...	...
484G	<i>Paspalum scrobiculatum</i> *	...	Native paspalum...	Air-dried	9.19	2.64	9.06	39.32	32.70	7.09	8.44	1.45	1.35	...	...	6.9	185
479G	<i>Cynodon dactylon</i> *	...	Tall couch grass ...	Green ...	77.54	0.57	2.18	11.81	6.06	1.84	2.06	...	...	...	...	7.5	183
				Air-dried	11.32	2.45	8.62	46.64	23.90	7.27	8.13	1.38	1.30	...	...	...	...
				Green ...	57.09	0.76	4.25	21.82	13.22	2.86	3.67	...	...	...	...	...	171
				Air dried	8.58	1.63	9.06	46.47	28.17	6.09	7.81	1.45	1.25	...	...	8.0	...

COMPOSITION OF HAYS.

485G	<i>Paspalum scrobiculatum</i> *	...	Native paspalum...	...	10.38	1.95	7.00	45.83	27.13	7.66	6.88	1.12	1.10	...	...	8.9	153
483G	<i>Pennisetum unisetum</i> †	...	Natal grass	...	7.82	1.49	7.31	40.16	34.20	9.02	6.56	1.17	1.05	...	...	9.0	142
481G	<i>Brachiaria brizantha</i> *	...	False paspalum ... (fine leaved)	...	10.29	2.33	8.44	41.44	26.75	10.75	6.25	1.35	1.00	...	...	9.3	139
492G	<i>Chloris gayana</i> †	...	Rhodes grass	...	8.43	2.07	8.50	38.47	33.09	9.44	5.94	1.36	0.95	...	...	9.8	130
483G	<i>Setaria aurea</i> *	...	Golden T mothy ...	...	8.57	1.51	6.25	36.83	36.62	10.22	5.31	1.00	0.85	...	...	10.7	116
488G	<i>Tricholena rosea</i> *	...	Common red top...	...	7.58	1.59	5.69	41.52	36.82	6.83	5.31	0.91	0.85	...	...	11.6	115
490G	<i>Paspalum virgatum</i> †	...	Upright paspalum	...	8.90	2.20	4.69	42.60	34.97	6.64	4.38	0.75	0.70	...	...	14.2	96
497G	<i>Tricholena setifolia</i> *	...	Bristle leaved red top	...	8.93	2.31	5.81	40.31	34.55	7.79	4.06	0.83	0.65	...	...	15.0	89

* Indigenous grasses (native to Rhodesia). † Exotic grasses (not native).
 ‡ The method adopted for calculating albuminoid ratio on total percentages was as follows:—
 Carbo-hydrates + fat + $\frac{1}{2}$ (non-albuminoid nitrogen \times 6.25 + crude fibre)

True protein

waste of nitrogenous body tissue, a supply of protein in the diet of an animal is essential, as the fat and carbohydrates contained in food cannot perform that function. On the other hand, protein, fat and carbohydrates in a ration can all be used to preserve the heat of the body and to produce body fat. The protein of foods, in fact, can perform all the functions of carbohydrates and fat in building up animal tissue, but a diet supplying an excessive amount of protein would be wasteful, owing to its high cost in feeding stuffs and the fact that that excess would be used to produce animal fat and preserve the body temperature, for which purposes the cheaper nutrients (carbohydrates and fat) of feeding stuffs can be supplied.

Rations should therefore provide protein and non-proteins (carbohydrates and fat) in the proportion and amount required for maintenance and for furnishing the growth or special production which the feeder desires. The ratio of digestible protein to the starch equivalent of the digestible non-proteins in a feeding stuff (protein=1) is commonly called its nutritive ratio or albuminoid ratio, and the smaller the ratio the higher is the proportion of protein to non-proteins. In the case of the grasses dealt with in this article, digestion co-efficients based on the results of feeding trials, *i.e.*, the percentage amount of each nutrient which is digested, are not available, consequently their albuminoid ratios based on total percentages have been calculated.

Grasses being naturally most palatable when young, their relative palatabilities and feeding values should be determined as near as possible at the same stage of growth; the samples analysed have, therefore, been grouped in the accompanying tables according to the stages of growth at which they were taken, *viz.*, (a) before flowering, (b) in the flowering stage, and (c) in the flowering and seeding stage. Owing to natural variation in the rapidity of growth of different species and the fact that the shoots from one root do not flower and seed at the same time, the samples grouped under each of the above headings may not be in exactly similar stages of development, consequently particulars are given concerning the period of growth represented, and the maximum and minimum lengths of the specimens comprising each sample.

As the crude protein of grass and hay very often includes a considerable proportion of nitrogenous ingredients which are not true protein and which cannot function as protein in animal nutrition, the percentage amount of true protein contained in each sample has been determined, and the samples under their respective headings in the above table have been arranged in the order of their richness in true protein per ton of dry matter. Subject to the limitations already stated with reference to the difficulty of grouping grasses at exactly similar stages of growth, and given that the samples in each group are equally palatable and equally digestible, it is reasonable to assume that the one which contains the higher proportion of true protein is the most nutritious. The order in which they are placed in the table therefore affords a useful guide to their relative feeding values. The provisos as to palatability and digestibility must be stated when

basing the relative feeding values of foodstuffs on their respective compositions, because both are so vastly important.

False paspalum (fine leaved), native paspalum, and upright paspalum were each analysed at two stages of growth, and the marked fall in their contents of true protein as the grass advances to maturity is to be noted. Grasses have the highest feeding value at the time of flowering, after which their contents of protein fall and crude fibre increase, consequently hay grasses should be cut for making hay, if possible, when the major part of the crop is in the flowering stage of growth.

The composition of a grass being influenced not only by stage of growth, but also by the character of the season and the situation in which it is grown, in order to determine its average composition, analyses of a number of samples are required, but the information so far obtained will be of interest to all stock owners, consequently this preliminary report has been prepared thereon. This report only covers a certain number of the grasses under observation on the Salisbury experiment station, and it is proposed to continue these investigations with all the other more promising varieties not yet dealt with.

Beatrice District Farmers' Association.

We have been asked to draw attention to the change of name of the Charter-Mgezi Farmers' Association to that given above. Mr. Walter Krienke is the honorary secretary, and meetings are held on the last Thursday in each month at the Farmers' Hall, Beatrice.

The Ground Nut or Monkey Nut.

By C. MAINWARING, Agriculturist.

(Bulletin No. 188 of 1914 revised and brought up to date.)

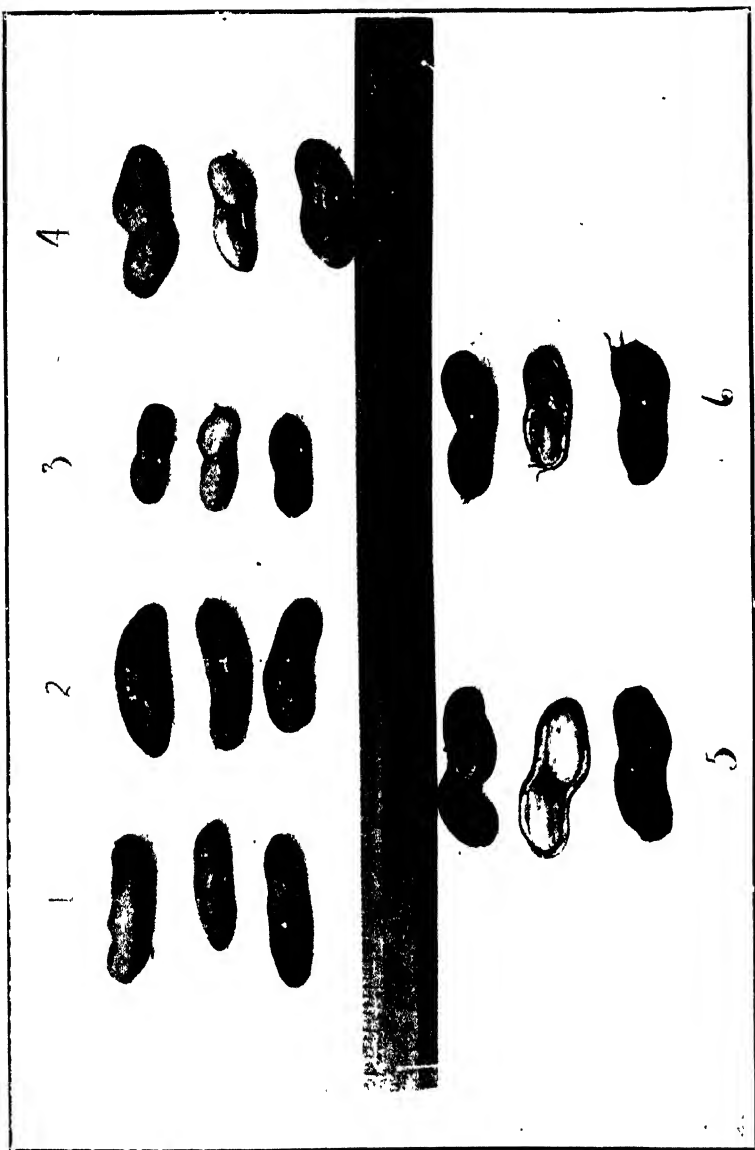
The ground nut, or *Arachis hypogaea* as it is botanically called, belongs to the pea-family, though it differs from all other members of this large group in its peculiarity of producing its seed underground. It is a somewhat clover-like plant, and a well grown crop is a pleasing sight, suggesting a luxuriant field of clover. The flowers, which are pea-like and of a bright orange colour, are produced one at a time from the large buds at the base of the leaves. Their life is a short one for the most part, as they wither on the same day that they open. All the flowers produced do not bear fruit; many never advance beyond the blossoming stage, and are considered to be the male flowers. When the nut-bearing flower is mature, the flower stem lengthens out and bends gradually downwards to the ground, where in due time it forms its fruit.

Local Production of Ground Nuts.—Considering the large areas of land in Rhodesia suitable for the production of ground nuts, the crop has not yet received that attention which is due to it, and for six years until the season 1920-21, there was no marked annual increase in acreage or yield.

PRODUCTION OF GROUND NUTS IN S. RHODESIA, 1914-21.

Season.	Acres under cultivation.	Total yield (bags of 83 lbs.).	Average yield per acre (bags of 83 lbs.).
1914-15	1,523	10,471	6·9
1915-16	3,043	22,415	7·4
1916-17	3,820	24,328	6·3
1917-18*	2,355	6,508	2·7
1918-19	1,706	10,589	6·2
1919-20	2,430	16,574	6·2
1920-21	4,414	25,596	8·0

*The excessive rainfall which fell during this season is responsible for the low yield.



Ground nuts (1) Spanish, (2) Tennessee Red, (3) North Carolina, (4) Native, (5) Virginia, and (6) Virginia bunch.

Types and Varieties.—There are two general types of ground nuts: one which grows upright or in a bunch, the other throwing out spreading vines or runners. The Spanish bunch and Virginia bunch are examples of the bunch type, while the Virginia runner—formerly grown extensively in Rhodesia—and the kaffir variety are examples of runner types. The bunch type is the more desirable, since in planting the rows may be spaced closer together, and the distance between the plants in the rows may also be less than with the spreading varieties. In spreading types, the vines remain more or less prostrate on the ground, and nuts are produced all along the length of the runners. With bunch varieties, as the name implies, the foliage grows in an upright bunch 6-10 inches in height, and the nuts are borne around and close to the crown of the plant. The tops or vines for hay, and the nuts too, are therefore more easily harvested with bunch varieties.

The four following varieties have been tested for a number of years at the Salisbury experiment station and also over larger acreages on the Government experiment farm, Gwebi:—

Spanish Bunch.—This is a medium late variety, taking about 4½ months to mature and producing moderate sized kernels, the outer skins of which are of a bright red colour. Two and three and sometimes four nuts are produced in each pod.

Tennessee Red is very similar in appearance, but usually has only two to three nuts in each pod, and the skin of these is of a rather darker red than that of the Spanish.

The North Carolina has a smaller pod, containing as a rule only two kernels, with skin of a yellowish colour, and takes two to three weeks longer to ripen than the Spanish.

Virginia Bunch produces the largest pods, which contain as a rule two very large nuts, with skin of a pale pink or brown colour. This variety matures in about five months.

Spanish bunch and Virginia bunch having been proved superior croppers and best suited to local conditions over a number of seasons, the other two varieties, together with the native variety, have almost entirely gone out of cultivation.

Climate.—Climatic conditions over the whole of Rhodesia are favourable for ground nut growing, and the season for planting may extend from mid November until the beginning of January. The crop seldom suffers from drought, and on suitable soils crop failure is practically unknown. A prolonged wet season, such as that of 1917-18, is almost certain, however, to reduce the yield.

Soil.—Large areas of land in all districts are well adapted to the growing of ground nuts. The crop can be successfully grown on soils that are considered too poor for maize. As already stated, the nuts are produced below the surface of the soil, and since they require to increase in size and bulk with ease, it follows that deep, sandy or loose,

light, loamy soils usually give the best results. Any sandy soil, however, or even heavy soils which are mellow and friable and which can be worked up into a fine loose condition, can be made to produce good crops. Soils that are excessively sour should be sweetened by a dressing of lime, but a limy soil is neither necessary nor apparently advantageous. On some soils good foliage and numerous pods will be produced, but the crop of nuts may be disappointingly small. This will probably be due to sourness or poor drainage, or even to extreme richness of the soil.

Manuring.—Farmyard manure or fertilisers are not usually applied to ground nuts in Rhodesia. If the soil has been manured for a previous crop, or if it contains a fair amount of humus, it is not advisable to apply any additional manures. When it is considered necessary to use fertilisers, these should be broad-casted on the ploughed land and worked into the soil with the disc or drag-harrow. On sandy soil kraal manure may be used in limited quantities. Heavy applications of manure applied at planting time sometimes produce excessive foliage and only a small yield of nuts.

Preparation of the Land.—If possible, the land should be ploughed twice; first at the beginning of the winter and allowed to lie rough, exposed to the effects of the atmosphere, and then in spring reploughed and worked down to a fine tilth with the disc or other harrow, until the soil is made as fine and friable as possible. If the tilth is lumpy, the roller can be used in these operations, but before making use of the roller it is a good rule to be guided by how the clods break when kicked with the heel of the boot. The roller is doing very little good, and may be doing much harm to the tilth, if it is simply forcing the clods into the ground, and thus only producing a seemingly fine surface instead of actually breaking down the lumps. Depth of cultivation, thorough preparation of the land, and a fine seed bed before planting, are all-important.

Selection of Seed.—Great improvement in the yield can be made through the careful selection of the seed. When selecting seed, care should be taken to ensure that only large, well-filled pods are chosen; the nuts should be kept in the pods until required for planting, and when shelled they should be plump and free from mould and decay.

Planting.—The planting season is practically the same as for maize, and the crop takes about the same time to reach maturity, the plants making their best growth during the early summer. Comparatively early planting is usually, therefore, to be recommended. About 30 to 40 lbs. of shelled or about 50 to 55 lbs. of unshelled nuts, according to variety and distance of planting, are required to plant an acre. Although not essential to shell the nuts before planting, the best results are obtained from the use of shelled seed. Varieties having two or more nuts to the pod will often give more than one plant to a hill, which is not desirable, and where unshelled seed is planted in dry soil, germination is slow and uneven. When the crop is sown with a planter, the use of shelled seed is a necessity. For machine planting, the leading agricultural machinery firms stock and supply special ground nut attachments for the maize planter.

Hulling by hand is a slow process, but is nevertheless advisable, since machine hullers split and damage many of the nuts, and injure their germination. One hundred pounds weight of selected pods of the Spanish bunch will give 70 lbs. of shelled seed. It is usually estimated that one native can shell 25 to 30 lbs. of seed per day.

The nuts should be planted on the level. Land requiring ridging, owing to insufficient drainage at the time of planting, will not be suitable. Seed should be planted two to three inches deep. The distance of planting depends upon the variety grown. Experiments conducted with the two bunch varieties which have proved best suited to local conditions, to test whether closer planting is desirable than is usually practised in Rhodesia, have shown the following results:—

Variety.	Date planted.	Distance planted.	Yield of unshelled nuts per acre.
Spanish	15/12/20	24 x 6 in.	1,280 lbs.
Virginia	15/12/20	24 x 6 in.	1,160 lbs.
Spanish	16/12/20	18 x 6 in.	1,668 lbs.
Virginia	16/12/20	18 x 6 in.	1,616 lbs.

It is hardly necessary to point out that 18 inches between the rows is too close to permit of other than hand cultivation. The most suitable distance for the bunch kinds seems, therefore, to be rows about 28 inches apart (the closest distance at which the planter can be set and at which the cultivator can conveniently work), with plants six to nine inches apart in the rows. No hard and fast rule can, however, be given, as the fertility of the soil must necessarily be an influencing factor. If the weather is favourable, the plants should be up in eight to ten days. Should there be any missing plants after two weeks, it may be advisable to replant where the nuts have failed to germinate, but such failures will not usually occur if shelled and graded seed of good quality is sown.

After Cultivation.—Cultivation between the rows must be thorough and frequent from the time the plants appear above the ground until the blossoms fall and the nuts begin to form or “peg” as it is termed. If the “peg” is unable to penetrate the ground, it will wither and no nut will be produced. The soil around the plants must, therefore, be kept loose, particularly when they are coming into flower, so that the pods shall not be stunted in their development.

It may not always be possible to reach with the cultivator such troublesome weeds as wild rapoka grass, Black Jack, etc., in which case hand-hoeing becomes necessary. Clean land in the first instance and early and frequent use of the cultivator will ensure the minimum of hand labour. The implement best adapted for the cultivation of the growing crop is the single horse or mule cultivator. At the final cultivation, and especially on soils which cake or crust on the surface, the plants may be slightly ridged up, care being taken not to cover the foliage. The wing shovel plough is best adapted for this purpose. The plants when fully grown should cover the ground in the rows completely so as to shade it from the sun's rays, and to conserve all the moisture possible.

Harvesting.—The crop is ready to harvest when the leaves assume a yellowish green colour, a sure sign that the pods are reaching maturity. The nuts mature unevenly, and if the last nuts formed are permitted to ripen before digging, the early maturing ones will commence sprouting. Generally speaking, harvesting should be done in dry weather and before the first frosts. If frosted, the foliage becomes brittle, and much will be lost and the remainder reduced in value for hay, while the nuts will become detached from the pod stems and be difficult to harvest. Different methods of lifting the nut are employed, but any contrivance which will cut the tap-root just below the pods and loosen the soil, so that the plants may be lifted, is satisfactory. In loose soil, a potato digger will give fairly satisfactory results, as will also a single furrow plough with the mould board removed. The usual method of harvesting ground-nuts in Rhodesia is, however, by hand, natives being sent along the rows to loosen the plants with hoes, and then pull up the plants. As the nuts of the Spanish variety adhere well to the stems, they may be pulled up without trouble or loss if the soil is first loosened. Any pods which remain in the ground can be picked out on ploughing the land, or pigs can be turned in to grub about and feed on them.

The plants after being lifted are thrown into windrows, usually three rows in one, where they are allowed to wilt. If the foliage has fallen off, and the stems are somewhat dry, the nuts may be made into cocks, without having been previously put into windrows. The length of time the crop will take to cure will depend on the climatic conditions. If the weather remains dry during harvesting operations, the nuts will be fit for picking in five to eight days. Fitness for picking and bagging is indicated by the pods being properly dry and the nuts firm. Picking nuts from the vines is slow work, and is a heavy item in the cost of production. Under favourable circumstances natives can pick 80 to 90 lbs. of pods per day. Very much depends, however, on the quality of the nuts. In other countries where cheap labour is not available, mechanical pickers have been adopted with success and profit.

Yield.—Returns per acre necessarily vary according to the treatment the crop receives, the climate and the variety. In Rhodesia, under normal conditions, yields of 12 to 15 bags of unshelled nuts per acre—a bag weighing 80 lbs.—should be regarded as an average crop, though yields of 35 to 40 bags per acre are produced under exceptionally favourable conditions.

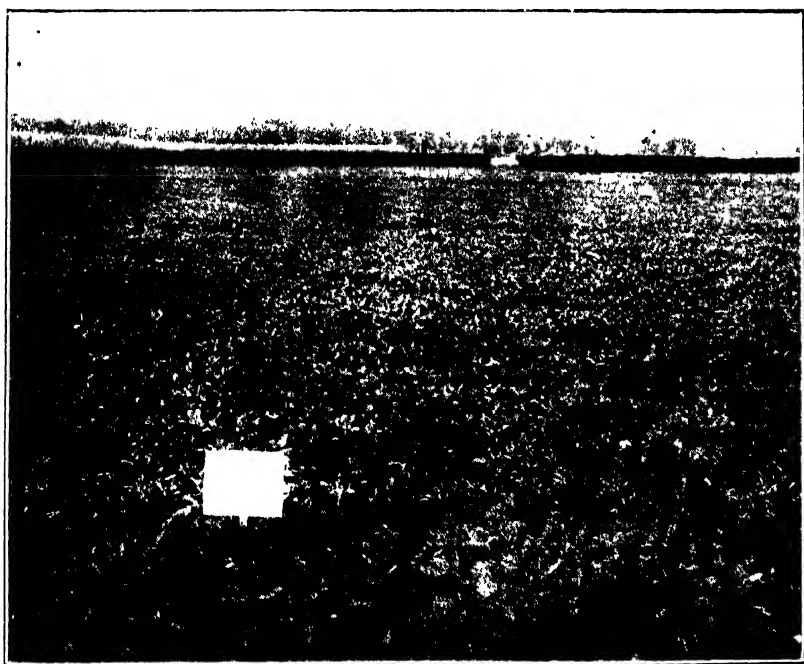
The following summary gives the average yield, season by season, of all varieties with which experiments have been conducted on the Salisbury experiment station, the Gwebi experiment farm, or under the co-operative experiment system :—



Showing the different manner in which the nuts are carried on the bunch
and runner varieties respectively. On left Virginia bunch, on right,
Virginia runner



Spanish lunch ground nuts Agricultural Experiment Station, Salisbury



good stand of ground nuts closely planted.

Year.	Spanish.	Virginia bunch.	Virginia runner.	Carolina.	Tennessee.	Native.
1912	1,100	1,000	1,180	1,320	...	592
1913	2,968	...	800	644	684	..
1914	476	776	784	548	496	.
1915	1,094	1,540	...	...	940	.
1916	1,115	1,313	..	1,112	1,380	..
1917	830	...	.	...	...	.
1918	...	.	.	...	..	.
1919	699	...	.	...	...	.
1920	992	1,056	..	720	636	...
1921	982	1,338		.	..	..

The above figures cannot be employed for making a comparison of the relative yield of each variety, since the treatment was not in every case instituted with the object of obtaining maximum yields. A comparison of each variety on equal terms during this period is given below.

Average yield in comparable variety trials:—

Spanish	1,233 lbs. per acre
Virginia bunch	1,244 „ „
Carolina	720 „ „
Tennessee	636 „ „

Average yield in comparable fertiliser trials—Spanish bunch only:—

First Series:

No manure	720 lbs. per acre
7 tons farmyard manure per acre	840 „ „
100 lbs. proprietary complete maize fertiliser per acre	710 „ „
100 lbs. proprietary complete maize fertiliser per acre	675 „ „
2,000 lbs. burnt agricultural lime per acre	680 „ „

Second Series:

On new land, no manure	392 lbs. per acre
On old land, no manure	790 „ „
On old land, with 200 lbs. proprietary fertiliser per acre	875 „ „
On old land, with 200 lbs. fertiliser per acre	740 „ „

Average yield under different methods of planting:—

	1916.	1917.
On ridges	970 lbs. p.a.	750 lbs. p.a.
On the flat	1,200 „ „	860 „ „
On the flat and subsequently ridged	1,128 „ „	900 „ „
On the flat and earth thrown up around plants at flowering stage	-	960 „ „

Effect of previous cropping on ground nut crop, 1920-21:—

After field radish	704 lbs. per acre
After wheat	745 „ „
After ground nuts	496 „ „

Effect of different distance of planting on yield:—

1917. Seed planted 12 ins. apart in row, rows 30 ins. apart	920 lbs. p.a.
„ „ 15 „ „ „ „ „ „	928 „ „
1920. Seed planted in rows 36 ins. apart, plants 15 ins. apart	656 lbs. p.a.
„ „ „ 18 „ „ „ „ „ „	1,056 „ „
1921. „ „ „ 24 „ „ „ „ „ „	1,220 „ „
„ „ „ 18 „ „ „ „ „ „	1,602 „ „

Diseases.—Thus far in Rhodesia the crop has shown itself remarkably free from disease and insect pests. Occasionally leaf spot or anthracnose is noticeable on some of the plants. The disease makes its appearance on the plants toward the end of the growing season, and in the same kind of weather that induces rust in summer wheat. Up to the present, however, the loss from this cause has not proved serious. This is due possibly to our soil being free from contamination owing to its almost virgin state. However this may be, the disease can be controlled by spraying with Bordeaux mixture, by a proper system of rotation and to some extent by seed selection.

Ground Nuts as a Hay Crop.—The crop is one of prime importance to the farmer not only for the production of nuts, but also for the tops and stems of the plant, which make a valuable hay of excellent feeding quality, and which should yield from half to one ton of dry fodder per acre. The tops must be cured before they are frosted or become too ripe, as this greatly reduces the yield and the feeding value of the hay. Since ground nuts are a leguminous crop, the tops are rich in protein, and are about equal in feeding value to lucerne hay.

Ground Nuts as a Rotation Crop.—The ground nut may be used in rotation with such crops as maize, tobacco and potatoes. Although a leguminous plant known to collect nitrogen from the air by means of its root nodules, the general experience of this Department and of farmers in Rhodesia, especially those of the Enterprise district, is that the crop depletes rather than improves the soil. The degree of soil improvement resulting from any leguminous crop will depend on the amount of the root system left in the soil. If the roots with their nodules remain in the soil, the effect on future crops will be beneficial. If, on the other hand, the roots are largely removed, as is the case

with ground nuts in this country, the reverse is likely to be the case. Experience further indicates that the crop should not be planted two years in succession on the same land. The largest yields of nuts are produced with proper rotation of crops.

Commercial Uses of the Ground Nut.—With two local oil mills operating in Salisbury, an assured market should be available for a large and increasing quantity of nuts. The oil mill of the Mark Harris Manufacturing Co. has a capacity of 10 tons of shelled nuts daily, or 2,000 tons per annum.

The Salisbury oil mill of the Farmers' Co-operative Industries, Ltd., last year crushed 8,000 bags of nuts, but the mill now has a maximum capacity of 20,000 bags per annum. The output of cake is about 43 per cent. of the weight of nuts shelled. The manager of this mill has kindly contributed the following notes on the commercial uses of the ground nut:—

“Ground nuts play an important part in the oil and soap trades, and their importance can be gauged by the fact that they always command a higher market value than most other oil seeds or nuts. The Spanish or Virginia bunch varieties which grow so well in Rhodesia contain 45 per cent. oil, while the kernels comprise 68 per cent. to 70 per cent. of the total weight of the nut. It is possible to extract all but 1 per cent. of the oil by the modern solvent extraction process. This consists merely of breaking down the nut or kernel with a coal-tar or petroleum product solvent which readily dissolves the nut. The residue is an oil cake practically free from oil, but containing a high percentage of albuminoids and of fibre, since it is usual to thus treat the nuts in the shell. Decorticated (shelled) ground nut oil cake as manufactured by the Salisbury Oil Factory contains 10 per cent. of fat and 46 per cent. of albuminoids (protein), making it a highly concentrated cattle food. The oil cake keeps well for months, and does not turn rancid as some oil cakes are apt to do. It is one of the best concentrated dairy feeds known, and compares favourably with decorticated cotton seed cake.

“In preparing edible oils which require very little chemical purification, it is customary to press the kernel only, and the resultant oil cake is, therefore, practically free from fibre. Ground nut oil is largely used as a substitute for olive oil, and enters in the compounding of all well known brands of salad oil manufactured by continental firms. The oil can be used also for illuminating purposes, and cold pressed oil can be used in all oil lamps. The oil can be hardened, and in this form is used in the manufacture of margarine. It is also used extensively in leather dressing and in the manufacture of furniture creams and in hair and cosmetic oils, and can even be substituted for fish oils in the manufacture of insecticides for spraying.

“For edible purposes, and since the oil can be hardened, it enters as a substitute for lard, butter and dripping. Ground nut oil is very wholesome, and can be taken internally as a medicine instead of olive oil. Since the oil is non-drying, it cannot, however, be used in the manufacture of paint, nor is it very satisfactory as a lubricant, usually

containing as it does some free fatty acid and being liable to become sticky. The most suitable purpose for the oil is that of soap making. It does not produce a hard soap, but in conjunction with other vegetable oils, it is possible to produce from it a very high quality soap which compares favourably with the best known soaps on the market."

***Oversea Markets for Ground Nuts.**—The extent of the oversea market is shown by the quantities imported in recent years into the United Kingdom, as follows:—

1917	...	...	...	...	...	...	...	...	137,758 tons
1918	...	...	...	...	...	...	...	...	135,758 "
1919	...	...	...	...	...	...	...	...	107,108 "
1920—									
Undecorticated	..	.	.	.	.	.	.	.	81,171 "
Decorticated (shelled)	..	...	...	...	...	...	...	...	43,123 "

Germany imported about 10,000 tons in 1920, but pre-war importations averaged about 70,000 tons; the 1920 importations of France were 220,000 tons undecorticated and 179,656 tons decorticated; last year (1921) Holland imported 24,016 tons of both classes.

At the time the report was made (November, 1921), the market was dull, prices having declined considerably during the prior few weeks, and brokers estimated that they could possibly make £20 to £22 per ton, *ex* ship, Antwerp, Rotterdam, Hamburg or Marseilles, and £19 to £20, *ex* ship, London or Liverpool, for decorticated nuts. These prices are for supplies of Coromandel, Chinese, Nigerian and East African nuts. In mid-December, 1921, the Union Trade Commissioner reported that the market had declined slightly owing to cheap offerings of Coromandel nuts, quotations for East African nuts being about £20 10s. for December shipments, and £20 for December-January shipments, per ton.

The present rate of freight on ground nuts is £3 per long ton (2,240 lbs.) for undecorticated, and £4 10s. for decorticated, from Union ports to the United Kingdom or continental ports.

A large percentage of ground nuts imported into the United Kingdom is of the crushing variety, which are mostly decorticated. Hand-picked "selected" for edible purposes are imported in equal quantities of the shelled and unshelled varieties. The German market offers a good opening for this article, while the French and Dutch markets would also take fair quantities.

* Extracted from a report recently published in the *Agricultural Journal* of the Union of South Africa.

Citrus Fruit Growing in Rhodesia.

By A. G. TURNER, Citrus Adviser.

There are many parts of Rhodesia that are entirely suitable for citrus culture, as regards climate and soil. At the present time considerable development has occurred in some districts, and this has all taken place during the last five or six years. Except for certain factors, mainly brought about by the Great War, there is little doubt that larger planting of citrus fruits would have taken place in Rhodesia, and the principal reason for any doubt as to the future of the industry has now been to a great extent overcome.

There is no denying the fact that during the last few years very grave difficulties have been experienced in disposing of the oranges when produced, on account of lack of suitable shipping accommodation, and as practically the whole of the Rhodesian and South African citrus growers are dependent on exporting their produce to European and other markets, this has been a very serious setback to the industry. During the 1921 season a crisis arose from the fact that sufficient shipping accommodation was not available; this made it impossible to export large quantities of fruit, which was in some instances actually packed and railed to the port. Although good Rhodesian and South African oranges realised excellent prices throughout the season, and the fruit was in good demand, these facts were of no avail, as fruit growers all over the country were acting as individuals and quite unorganised, with the consequence that shipping companies had no central body with whom to deal.

The fruit export trade was in a state of complete chaos through lack of any kind of organisation among fruit growers; so much so that the whole industry was in danger of a complete breakdown unless matters were put right, and that without delay. Now, it may safely be said that this very crisis has proved the saving of the fruit industry in this country, and similar instances are well known in the history of agricultural expansion in many parts of the world.

A central body, known as the "Fruit Growers' Exchange of South Africa, Ltd.," has come into being during the last half year, a purely co-operative concern, born of the necessity of all fruit growers getting together, in order to manage their affairs in a thoroughly businesslike manner. Rhodesian fruit growers are invited to federate with this central South African body on equal terms with their brother growers in the Union of South Africa, and have now formed a local association,

known as the "Rhodesian Co-operative Fruit Growers' Association, Ltd.," for this purpose.

It is not proposed here to describe the functions of the Fruit Growers' Exchange, suffice it to say that it is a non-profit co-operative concern, operated entirely by *bona fide* growers, represented by directors from the various local associations and district exchanges, all of which are federated to the central exchange, through a general manager, who, with his staff, manages the business for all members. The system adopted of financing the exchange is a form of levy per ton on all export fruit, which will be sufficient to maintain the whole working costs of the organisation.

The improved status of the fruit industry, which has been brought about by the growers getting together into a properly organised body, is already apparent in various ways; shipping companies have come forward and offered suitable accommodation, the railways recognise a definite body with whom they can co-operate, offices have been opened and are now operating for the assembling and inspection of fruit at the ports of export and for its despatch by ship. As soon as the exchange has got over these initial difficulties and is thoroughly established in this country, overseas agencies will be opened to distribute and dispose of members' fruit; the purchase of members' requirements will also be arranged by the exchange organisation.

It has been said above that prospective citrus growers have possibly been diffident of the future of the industry in this country on account of the various difficulties, but these are now happily disappearing, and if all fruit growers will work together for their own good, there is undoubtedly a bright future for citrus growing in Rhodesia.

Although the difficulties encountered during 1921 season were considerable, the amount of citrus fruit exported from Rhodesia was about 1-13th of the whole South African citrus export, which was approximately 240,000 boxes. The estimated output for 1922 is more than double that of last year. Considering the conditions in England during a great part of the time our citrus fruit was being sold, the coal strike and general trade depression, prices realised were excellent on the whole, excepting one period about the middle of June.

A statement received at the latter end of last year in correspondence from a firm of fruit distributors regarding the condition of the oversea markets generally, shows that fruit is in good demand. "General business over here is pretty slack, as you can imagine, but the fruit trade is about the only one which remains active, and we continue to hope for the best."

The figures given below represent the approximate average prices of Rhodesian oranges sold in England during 1921 season:—Gross sales England, 23s.; net Rhodesia, 16s. 6d.; net on farm, 10s. The first shows the actual price realised per box for oranges in England, the second the amount less railage, shipping freight, dock dues, commission, etc., the third being the net profit after deducting cost of growing, picking, box packing material, packing and hauling to

station. On the basis of only one box per tree, this leaves a profit per acre of about £40, according to the number of trees planted per acre.

A well-cared-for orange tree of five years old can produce one first-grade box of oranges, while a similar tree in full bearing, say at ten years, is capable of bearing three to four boxes of first-grade oranges; it will be seen, therefore, that an orange grove properly run can return a useful profit.

In California for the six years prior to 1920, it has been estimated that the average net profit per acre from orange trees was 90 dollars, or about £18, at normal rate of exchange.

In Rhodesia we have the opportunity of getting higher net returns from orange growing than is the case in California, by reason of our cheaper land, water, labour and transport, which points were made much of by many growers and shippers with whom I discussed the matter during my visit in 1920.

Californians are very optimistic in regard to orange growing in their own country, and consider that although it has its ups and downs in the markets and an occasional damaging freeze, on the whole it is a perfectly good investment as compared with other businesses, agricultural, trading or otherwise. The reasons for this opinion were generally stated to be that people have got into the way of using oranges as a regular thing, and *there are comparatively limited areas in the world where good commercial oranges can be profitably raised.* For these reasons, together with our other advantages, Californians expressed the opinion that Rhodesia and South Africa should be able to build up a good business in Europe, but that we must send only good fruit in sound condition, which will advertise itself; and, further, that we could with advantage make large use of advertising propaganda.

It may be stated that advertising propaganda is one of the objects of the Fruit Growers' Exchange of South Africa.

Selecting the Site.—In selecting a site for a citrus orchard, there are some points that must be carefully considered—transportation facilities, susceptibility of the farm to damaging frosts, suitability of the soil, availability of a perpetual water supply for irrigation and protection from prevailing winds. It is not advisable to plant citrus fruits far from railway lines, as wagon transport is slow and expensive, and, moreover, the pack will be ruined unless the wagon is very well sprung and the road is good. With regard to frost damage, one is fairly safe if there is no likelihood of more than 8 or 9 degrees, provided the orchard is naturally well protected from winds. If not, wind-breaks should be planted before the orchard is laid down:

Probably the first operation on the land will be to clear it of native trees and bush, which must be done thoroughly, leaving no stumps, etc. Suitable soils will be found in red soils, sandy loams and the lighter chocolate loams, provided they are deep and have not clay or ironstone sub-soils; also deep black granite and some lighter

grey soils. Turf and clay soils are unsuitable, and should not be considered. Whatever the soil is, good drainage is a *sine qua non*, as the orange, like most other fruit trees, must have dry feet. While it requires a plentiful supply of water, it is certain death if there is any possibility of stagnant water.

It must be remembered that the citrus tree is an evergreen, and consequently requires water right through the year to make satisfactory growth of wood and fruit. It should be borne in mind that citrus trees require more water than deciduous trees of equal size and age, which latter shed their leaves; therefore, transpiration is greatly reduced at this season, whereas the leaf area of citrus trees is the same in winter as in summer, so that a like amount of water is transpired all the year round. When citrus trees receive an inadequate amount of water they do not make a normal growth, but wilt and show signs of distress generally. The young fruit falls off, and what is brought to maturity is fairly certain to be deficient in juice and of poor quality. To have trees in such a condition is simply inviting the attacks of fungus diseases, scale insects, and any other kind of pests.

Oranges raised in Rhodesia without irrigation are practically certain to be delayed in their growth, and consequently blooming will not occur until the rains commence. A crop of out-of-season fruit will be set, which is of little or no value even for local markets, and of none at all for export to European markets, which must be the ultimate goal of the bulk of Rhodesian-grown oranges. The trees will no doubt have endeavoured to bloom at the right time, viz., in August, and even have set a small crop of oranges, which are likely to be of very poor quality. It is not good business to subject an orange tree to any unnecessary hardship and lack of water at the right time.

I would remark that it is so much waste of time and money to lay out a citrus orchard *without facilities for irrigation*, even assuming that there is an annual rainfall of 30 ins. during the wet season, say, from November to March inclusive; this leaves a most important period in the annual life of the tree without a supply of water. If the 30 or 40 ins. were evenly distributed throughout the year that should prove sufficient, but as we are not able to control the elements at will, we must make use of artificial application. It is possible to raise an orange tree, of a sort, without irrigation up to the time of bearing, although it will not be the tree it would have been had it been irrigated at the proper time. When the tree reaches bearing age it would appear to be common sense that a fruit which consists mainly of water cannot be raised unless it receives water at the right time, and just when it wants it. Undoubtedly an orange tree will produce fruit here on the annual Rhodesian rainfall, but not sufficiently so to make it a satisfactory commercial undertaking.

It may be said that useful rains occur in Rhodesia during four months, but a large volume of this falls in such heavy downpours that a very large percentage runs to waste and is of little value to trees. For this reason I consider it is not sound to calculate the

amount of water required by irrigation by annual rainfall. For instance, if during a wet season 30 ins. of rain fall and 40 ins. by rain and irrigation water are taken as the full amount of water required to raise a paying crop of oranges, it would appear to be necessary only to apply 10 ins. by artificial means, whereas the trees might actually require, say, twice that quantity on account of a large proportion of the 30 ins. rainfall having occurred over a short period and mainly in heavy showers.

When the land has been thoroughly cleared of timber and bush, it should be ploughed very thoroughly, and if the sub-soil is inclined to be stiff it must be sub-soiled, but this would not be necessary in the lighter loams. Then a harrow and cultivator should follow until the land is perfectly worked up and level, as, if the grove is planted in an uneven condition, it will prove to be a considerable nuisance in after years, and will interfere with all kinds of cultivation and irrigation among the trees.

Before commencing to prepare the land for citrus planting, make sure by actual test or thorough survey that water can be led all over the land under consideration; if this is impossible, grade the land so that water can be successfully led to every tree. The ideal grading is when irrigation can be performed from two sides of the orchard; in this way irrigations can be applied from these two sides, turn about.

The orange can be transplanted at any time of the year under favourable conditions, but usually the best time for this operation is after it has hardened up the first growth, and before the second commences, which usually coincides with the beginning of the wet season, about mid-November, as by planting at this time when the ground is warm the tree is quickly established and commences to grow right away, and by the end of the growing season should have put on considerable growth. If an orange tree is planted in winter it makes no growth until the spring, but has to be irrigated all this time, and one planted later than February does not get properly established before the end of the growing season, and consequently requires greater attention during the whole of its first year. Young orange trees planted out very late in the season receive very severe check, from which it takes two seasons to recover, while many never recover.

Varieties to Plant.—Budded orange trees should be two to two-and-a-half years from seed to time of transplanting into orchard, and the most suitable stock for this country has so far proved to be the Mazoe or rough lemon. This stock is the most resistant to collar rot, and therefore the safest for the average planter to make use of. Practically all orange trees sold by reputable nurserymen in Rhodesia and South Africa are on rough lemon stock.

We may consider that practically all citrus plantings in this Territory will be laid out with a view to exporting the fruit overseas; therefore, it is advisable to plant only those varieties most acceptable for this purpose. The most suitable varieties to plant for export are:—(1) Washington Navel, (2) Valencia Late, (3) Jaffa, (4) Joppa, (5)

Mediterranean Sweet, (6) Paper Rind St. Michael. The first two named are undoubtedly the prime favourites at present, and these by judicious picking can keep a packing house supplied during almost the entire export season.

Washington Navel is the most popular orange in the world. It always commands top prices wherever put up for sale, and there seems no reason to expect that it will lose its place as the best money getter, early to mid-season. It is seedless where properly grown. The season for export is from mid-April to end of June or mid-July.

The Valencia Late is not quite seedless, but it should contain only a few seeds. It is a late variety, and bears good medium large, rather oblong fruit. Season for export from early August to mid-October.

Jaffa is another orange containing few seeds, borne on an almost thornless tree, of large size, medium to late season. An excellent variety that bears large crops of fruit that is very acceptable in Europe, and I believe is likely to be largely planted in future. Export season, June-July.

The Paper Rind St. Michael orange has few seeds and a very thin skin; it is of good quality, but small; medium mid-season.

Joppa a little later than Jaffa, medium to large size; carries and sells well in Europe; a good mid-season variety.

The object of the planter for export should be to be represented by the best varieties over the whole period of the export season, which is from mid-April to mid-October.

With regard to planting orange trees from seeds, this practice is not advisable. Some seedling trees produce excellent fruit, but one cannot depend on the result of planting seedlings, as the fruit may prove quite worthless for export purposes, although grown from seed taken from particularly fine fruit; moreover, they take longer than a grafted tree to come into bearing, and require more space in which to grow. They are also more expensive to handle in every way; in picking, spraying, fumigating, etc., as the tree grows to an immense height, whereas a budded tree can be kept comparatively low and easy of access for all purposes.

A budded orange tree, with proper attention, will commence to produce fruit in the third year from transplanting, but in no appreciable quantity. One should not expect much return until the fifth year, although many trees in Rhodesia have produced a good crop of fair fruit in the fourth year.

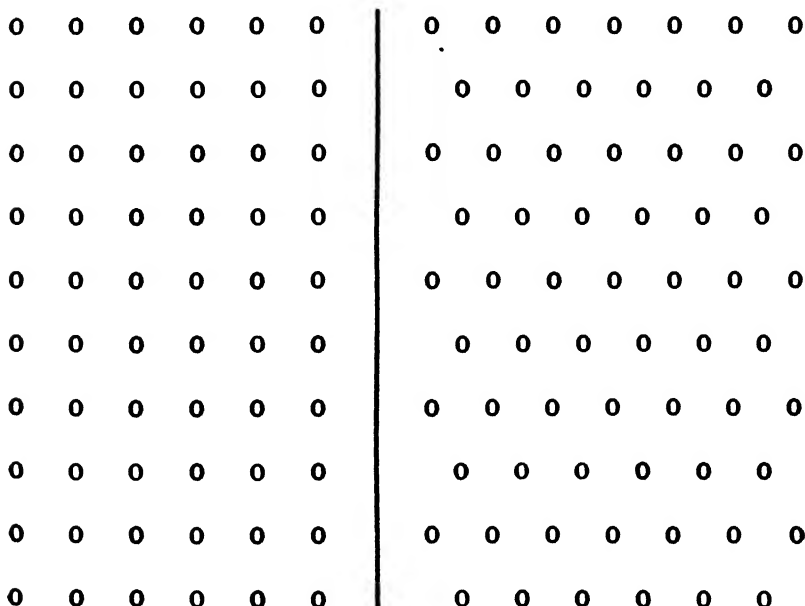
It would be as well to warn planters that in purchasing young trees it is always advisable to buy the best obtainable. This is more particularly the case with the Washington Navel, as unless this variety is propagated from a reliable strain, it may be found when the trees come into bearing that trees have been planted which, as far as this variety goes, are practically worthless. A Washington Navel, unless true to type, loses at least half its commercial value. Therefore, do not buy anything but the best tree of any particular name, and place your orders with firms who cannot afford to lose their names.

One great point in favour of citrus fruits from Rhodesia and South Africa generally is that they ripen during a part of the year when the European and American markets are bare of this class of fruit. Of course a great deal—in fact, everything—depends on the grower himself, as to the yield per acre and per tree.

Planting Operations.—Assuming that a suitable site for an orchard has been selected, and that the land has been thoroughly cleared of trees, stumps, rocks, etc., and has also been levelled so as to admit of water being led over the entire block, it should now be in a condition ready to lay out for the permanent orchard. If necessary, windbreaks should already have been planted.

Unless the land for planting has been really well worked up, it would be much better to plant a crop of some kind instead of laying it out at once to fruit trees. Maize, being a useful crop to open up the ground, can be grown to advantage, but if the soil is inclined to be poor it would pay better to plant a leguminous crop in the spring, which would be ploughed under in the summer when in bloom and left to rot in the ground.

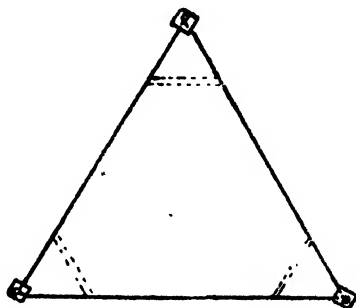
It is very desirable that the trees should stand in straight lines, both for convenience and symmetry, and this can be achieved in many ways of laying out an orange grove. It is only proposed to deal with two methods, namely, the square or rectangular system, and the hexagonal or equilateral triangle system. The accompanying sketches show the difference between the two systems:—

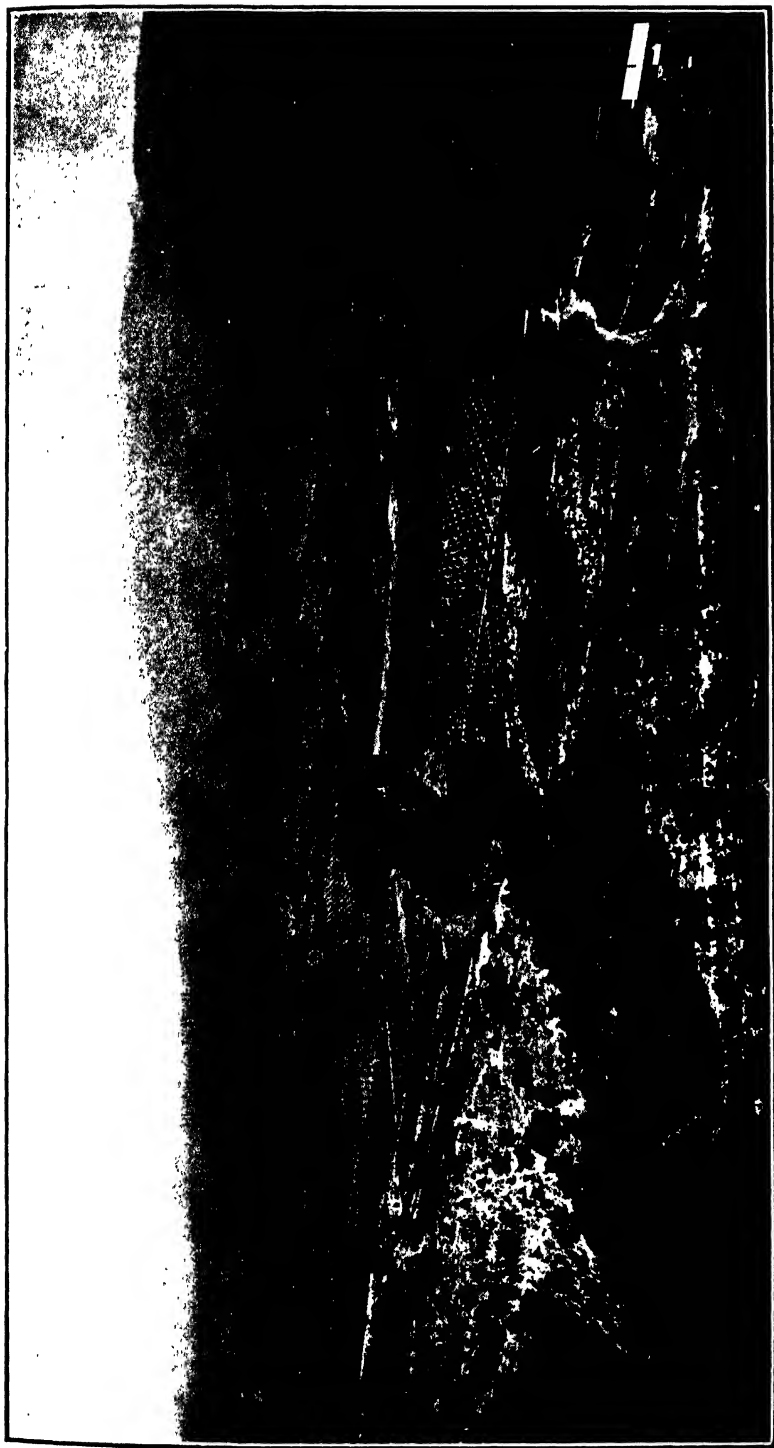


On the square or rectangular system trees planted at 20 ft. will give 108 to the acre, at 22 ft. 90, and at 24 ft. 76. This system allows more room for each individual tree than any other, and also gives better opportunities for ploughing, cultivating and irrigating than any other method. Planted on the hexagonal or equilateral system at 20 ft. apart, there are 126 trees to the acre, at 22 ft. 103, and at 24 ft. 86. The trees stand equi-distant from one another right through, and economy of space is thus secured; but, on the other hand, there are not the same facilities for general work. Therefore, on the whole the most satisfactory system is the square or rectangular. A measuring wire or chain is the best means for getting accurate location of trees, and this can be made from two or three strands of ordinary baling wire twisted together. The wire must have been previously thoroughly strained, otherwise it will be liable to stretch when in operation. At each end of the wire a strong ring should be attached, and along the wire at every 20 ft., or whatever distance it is decided to plant at, a piece of red cloth, copper wire, or any distinctive material, must be inserted by separating the strands and made fast so that it cannot slip.

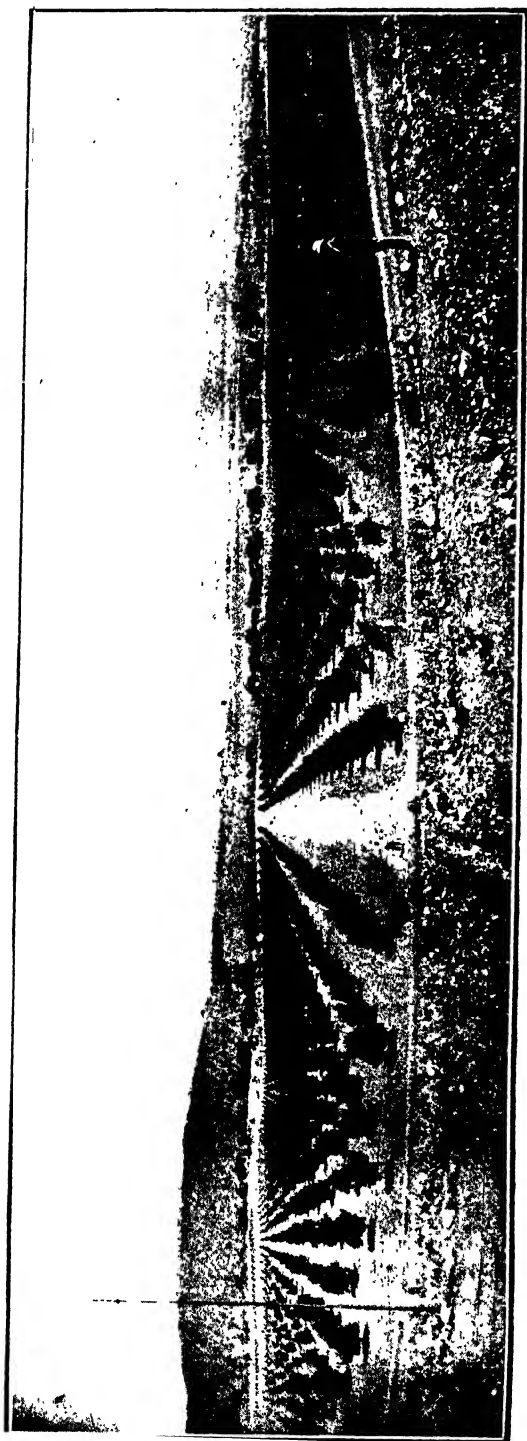
The Square System.—First of all mark out the base line, which should be about 100 ft. from the windbreak and parallel to it, by stretching the measuring wire at the required distance from the windbreak or boundary line. Place a stake at each of the distance tags on the wire, and these stakes will represent the first row of trees. The next thing to do is to find a square corner, which is easily done by marking off 80 ft. on the base line, and then at a point 60 ft. as nearly at a right angle to the base line from the corner stake as the eye can judge. If it is found that the distance between these two points first taken is 100 ft., a true corner will be obtained. Continue this line the whole length of the land to be planted and mark it off with the measuring wire at the desired distances. Repeat the same operations from the other end stake of the base line, which will give two parallel lines on opposite sides of the land. All that has to be done then is to connect up the first stake on each line with the measuring wire, and place a stake at each distance tag right across the land, and continue this operation right down the field. All the stakes must be set on the same side of the wire.

The Hexagonal System.—It is possible to lay out an orchard on





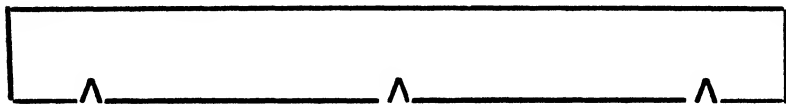
Premier Estate, Umtali. Property of British South Africa Company.



Mazoe Citrus Estate. Property of British South Africa Company.

this system by making a strong wooden frame, triangular in shape and equilateral, having the exact dimensions required and holes provided at each corner, as shown in the diagram. The best way to get these holes correct is to fix one-foot-square planks firmly at the apices with one inch hole bored, so that the inner ring of the holes exactly touches the point of the triangles. Lay off the base line as directed in the other system. Three men must then carry the frame, which is moved down the base line and placed over the stakes in place thereon, the apex of the triangle pointing inwards towards the land to be marked out and a stake driven in through the hole there.

The orchard having been laid out according to the system decided upon, the next operation is to mark out the position of the holes to be dug, for which purpose it is advisable to use what is known as a "planting board," as shown below. This is easily made from a piece of flooring board 5 ft. long by 5 or 6 ins. wide, a notch being cut exactly in the middle, and also at either end. The two outside notches must be exactly equi-distant from the centre notch.



The idea in using this board is that the rows of trees should correspond exactly with the stakes in the original lay out of the orchard.

In the operation of digging the holes, the centre notch is placed right up against the stake, which represents the spot where the tree is to stand, and a stake is driven into the ground at either end notches. The centre stake is then removed and the hole dug, care being taken not to shift the two outside stakes. Holes can be dug 2 ft. deep and 2 ft. 6 ins. across, and even to a lesser depth, provided the ground has been previously well worked up. In digging the holes the surface earth should be set on one side and the lower soil on another, the object being to have the top soil to place in direct contact with the roots when the tree is planted; the lower soil is used to fill up the hole with. Besides its use in bringing the trees into line, the planting board enables one to judge of the correct depth of setting the tree as compared with the surrounding ground, which is not easy to determine by eye if the hole is a large one.

When the time comes for planting, the soil that has been taken from the surface should be put back into the hole and brought up to a conical shape, so that the centre of the tree will stand on the top of the cone. Now take the planting board and set the two end notches exactly and closely against the two stakes, then take the tree, the roots of which should be trimmed with a sharp pair of shears in order to remove all that may be bruised or broken, and hold it firmly against the centre notch so that it stands on top of the cone of earth that has just been thrown up. More top soil is thrown in until the roots are well covered, and the planter then carefully works this earth into the roots with

his fingers, which do this job better than anything else. When the roots are all well covered, remove the planting board and get into the hole, tramping the earth well all round, taking care not to damage the roots. Then fill in a little more soil and fill up the hole with water. If the ground is of a very porous nature, or very dry, it is advisable to fill up the hole twice at least with water. Finally, when all the water has soaked away, fill up the hole to the level of the surrounding ground with dry soil and do not tramp it. When the job is finished, the tree should be standing a couple of inches higher than it originally stood in the nursery, as with the sinking of the soil it will be found the tree is standing about as it did in the nursery. The mark where the tree stood in the nursery is always quite well defined.

After planting, the top of the tree should be cut back to about 30 to 36 ins. and the stem painted over with whitewash, made by mixing 30 lbs. lime and 5 lbs. salt with enough water to make it flow well. Water should be given when needed, and it is best applied by removing the top layer of soil and repeating the same operation as at planting time for the first few months. The ground around the tree must be kept loose and not allowed to pack.

When trees are supplied from the nursery with a head of three or four branches already formed, do not disturb this head except to cut back, as shown in Fig. 5.

To secure ideal low-headed trees, they must be cut back at planting to about 30 ins. to 36 ins. of trunk, from which three or four buds at the top, say in the last eight inches, should be allowed to develop in branches, which will be the foundation of the future tree—nothing else should be allowed to grow. Three or four limbs are the leaders on which to continue building; consequently all the sap should be directed towards this framework and not allowed to run to waste in water shoots and otherwise redundant growth or suckers.

Constant watchfulness should be maintained for adventitious shoots starting out on the stem or limbs at points where branches are not desired or required. Wherever they start out strongly they should be pinched off, or, better still, entirely removed with a sharp knife. Suckers should also be removed at once, whenever discovered.

(To be continued.)

A Short History of the Infective Diseases

AMONGST THE DOMESTIC ANIMALS OF SOUTHERN
RHODESIA SINCE THE OCCUPATION.

(Continued.)

By J. M. SINCLAIR, M.R.C.V.S., Chief Veterinary Surgeon.

RINDERPEST.

Information regarding the introduction and rapid spread of rinderpest is very meagre, due, no doubt, to the native rebellions in Matabeleland and Mashonaland engaging the entire time and attention of the whole European community. The late W. H. (Curio) Brown, in his book "On the South African Frontier," writes as follows:—

"In the early part of February, 1896, Mr. R. T. Coryndon (now Sir Robert Coryndon, K.C.M.G.) returned from a sojourn on the Loangwa River, north of the Zambesi, and reported that European rinderpest, which for several years had been steadily working its ravaging course of destruction southwards through Central Africa, annihilating vast herds of native cattle and wild game, had crossed the Zambesi River. Little notice was taken of this announcement, for it seemed to be the general opinion that the plague would be confined to the low, sickly belts of country and would not affect the healthy plateau. Nevertheless, the disease soon appeared at Bulawayo, where every effort was made to check it, but in vain. About the middle of March it had broken out in Salisbury, and a fortnight later the commonage around the town, which had been recently dotted with stock, presented the appearance of desolation and death. Fully 97 per cent. of the cattle seized with the disease perished."

The disease was first officially reported at Bulawayo on 3rd March, 1896, and the rapidity with which it can be disseminated may be gauged from the fact that it had reached Palapye by the 10th and Tuli on the 16th of the same month, and Mafeking on 4th April.

The Administration at Bulawayo attempted to check the southward spread of the disease by shooting all cattle in a certain area, but unsuccessfully. The native cattle owners could not understand the destruction of healthy cattle, and no doubt their attempts to move cattle to avoid destruction actually resulted in a more rapid spread

of infection than would have occurred under ordinary circumstances. The disease spread to every district, a few isolated herds escaped infection, but it may be assumed that 95 per cent. of all cattle succumbed. It is difficult to form an estimate of the total number of cattle which died. At the end of March, 1898, it was estimated that there were 9,295 head of native-owned cattle in Mashonaland and 4,688 head in Matabeleland, a total of 14,000 approximately. If we add a similar number of European-owned cattle and deduct 3,000 head as the natural increase during the season 1897-8, the total survivors from rinderpest may be estimated at 25,000 head. If the losses from disease are taken at 95 per cent. of all cattle, the total number which died from rinderpest would be upwards of half a million.

Towards the end of 1897 it was decided to inoculate all the cattle in the Territory by the Turner-Kolle method, viz., a simultaneous injection of hyper-immunised serum and virulent blood, with the object of establishing an active immunity. In Matabeleland inoculating stations were established at Bulawayo, Ramaquabane, Gwelo, Manzi-nyama, Tuli, Khambi and Queen's Kraal. In August, 1898, it was found that the number of cattle entering the station had decreased considerably, and although police patrols were sent in all directions, and inspecting stations established on the main roads, few cattle could be detected which had not been inoculated. It was decided, therefore, to discontinue the use of virulent blood and use serum alone. All cattle arriving by road or rail were treated by the latter method. In all, 18,373 head of cattle were inoculated, of which 2,242 head received serum only. The result of the campaign was the complete eradication of the disease in Matabeleland. In Mashonaland the work was started early in 1898, but in a few months the double method of inoculation had to be discontinued, owing to the impossibility under the then existing conditions of obtaining virulent rinderpest blood free from the organisms of other diseases such as red-water and gall-sickness. Serum alone was then relied on for dealing with the sporadic outbreaks which occurred from time to time, and the last occurred on Salisbury commonage in September, 1898, and the treatment of all cattle in the vicinity, about 1,000 head, with serum, marked the disappearance of rinderpest from Mashonaland. The supply of serum, to begin with, was obtained from the Cape Government, but in view of the decision of that Administration to close the Kimberley rinderpest experimental station, the British South Africa Company leased this station for a period of three months and produced sufficient material to complete the treatment of all the cattle in the Territory and provide a large reserve in case the disease should re-appear. Some of this serum is still in existence, but it is doubtful if it would stand uncorking'

FOOT AND MOUTH DISEASE.

Foot and mouth disease appears to have passed through this Territory about 1892, but there is very little information on the subject. In his annual report for 1893, the late Dr. Hutcheon, then Chief Veterinary Surgeon of the Cape of Good Hope, says that "it was first heard of in Mashonaland and the northern part of the Trans-

vaal, and that it reached Griqualand West through the main traffic route from Bechuanaland." In his report for the following year he stated that in the Cape Colony it assumed a much milder form than in Europe, and that very few fatal cases occurred except through neglect, or when the disease appeared amongst oxen on the road, when the losses were sometimes heavy.

Since then the only outbreak recorded occurred in December, 1903, amongst some Government camels in the Goromonzi district. It was stated by the veterinary officer in charge that the disease was of a somewhat virulent type, a view endorsed by *post-mortem* examination. In all, five animals were affected, of which one was destroyed and four died. The animals involved were kept rigidly isolated, and all movements of stock in the district suspended. Fortunately, there was no further spread of the disease. The source of the infection was supposed to be "gram" imported from India for the use of the camels.

The accuracy of the diagnosis in this case is open to considerable doubt. In the first place, the camel is not at all susceptible to foot and mouth disease; indeed, Leese, a veterinary officer with extensive Indian experience, states that they do not suffer from it under natural conditions, and that he has tried to infect them in several ways without success. The heavy mortality suggests a more virulent and fatal infection than foot and mouth disease.

In 1900 a visitation of this disease was fortunately averted. Whilst Marandellas was the headquarters of the Rhodesia Field Force two ships arrived at Beira with supplies, including cattle amongst which the disease existed. All possible danger was prevented by the refusal to allow anything whatever to be landed from these ships.

ANTHRAX.

The first record of anthrax is to be found in a report by the veterinary officer in charge of the rinderpest inoculation stations in Matabeleland during 1898. At the Ramaquabane station 41 head of cattle died from this disease, and fortunately the measures taken for dealing with the infected carcasses proved satisfactory, no case of disease having been recorded in the district since then. In 1912 two outbreaks were dealt with, viz., at one of the Ardbennie plots adjoining Salisbury commonage and at the farm Umganin, about eight miles from Bulawayo. At the former centre of infection fourteen pigs and one donkey died, and at the latter six head of cattle. All the infected carcasses were burned or buried in lime, and at Umganin the site where the beasts died was fenced. In neither case has there been any further manifestation of infection. During 1917 the disease appeared amongst cattle on one farm in the Salisbury district and two in the Mazoe district, all in the neighbourhood of Mount Hampden. The total mortality was nine head. The following year four outbreaks occurred, one in the Mtoko district, one in Hartley and two in Makoni. In 1919 a virulent infection appeared in the Shamva section of Mazoe district, where 102 head of cattle died on eighteen farms. One case occurred in the Hartley district, and two oxen died on the

Macheke-Mtoko Road. During 1920 two fresh centres of infection were discovered in the Hartley district, and five head of cattle died. In the Mtoko district three head of cattle died at separate kraals where the disease had not previously been known. In the Shamva area cases occurred at five of the old and two fresh centres. The total mortality during the year was eighteen head.

The procedure in dealing with outbreaks has been the same throughout, viz., the utmost care taken in the disposal of diseased carcasses, vaccination of all animals in the herds or on the veld affected, and the suspension of cattle movements until completion of the vaccination process. The Pasteur double vaccine has always been used, with, as will be seen from the above record, most satisfactory results.

So far we have been extremely fortunate in regard to this disease. Every outbreak dealt with has been detected early, and the measures taken appear to have resulted in restricting the dissemination of infection to a minimum; but its existence at centres so widely apart throughout the Territory must not be lost sight of by all concerned, particularly the stock owners. Anthrax is a particularly virulent disease affecting cattle chiefly, but all the domestic animals are susceptible, and fatal results in the human subject are by no means uncommon. The greatest source of danger is the carcass of a diseased animal, in which the causal organism is present in enormous numbers, and wherever blood and other body fluids contaminate the ground there will the infection remain for an indefinite period, perhaps for generations. It will thus be readily understood how the disease will appear from year to year in certain localities, and grow in severity if the carcasses of all diseased animals are not effectively disposed of.

It is worth noting that, with one exception, all the known centres of infection lie to the north of a line drawn east and west through Hartley, which suggest that the conditions in the northern districts are more favourable to the perpetuation of the organisms of the disease than elsewhere. The infection is perpetuated in the soil by means of "spores" which are very resistant to all destructive agencies, and it is well known that these spores live best, perhaps increase, on certain classes of soil and under certain meteorological conditions. The disease is particularly observed on black, warm soils, on those containing lime and clay, on low-lying, swampy ground where water is constantly present, and on areas subject to flooding. Virulent outbreaks are frequently observed after a hot, dry spell following heavy rains or flooding. These conditions are certainly more common in Salisbury and adjoining districts than in the southern and western sections of the Territory.

It is possible that in one or two of the outbreaks recorded above the infection may have been introduced by bone and other organic manures, but it is more than likely that it has always existed. It exists throughout the whole of the African continent, and it would be rather singular to find any large area such as Southern Rhodesia free until occupied by Europeans, especially under the conditions which formerly existed, where the acquisition of cattle was frequently the

cause of tribal warfare. The apparent absence of the disease until recent years was probably due to there being so few cattle to come in contact with the soil infection, the result, of course, of the rinderpest and African Coast Fever invasions.

QUARTER-EVIL.

This disease was first recognised in 1911, when two outbreaks occurred, one at Insiza and the other at Redbank, in the Nyamandhlovu district. In both cases it appears that cattle had been dying for upwards of twelve months previous to the matter being reported, and that the cause was attributed to snake bites. During the same period a considerable mortality occurred amongst cattle on six farms in the neighbourhood of the Redbank centre of infection, also alleged to have been due to snake bite, but in none of these was the existence of quarter-evil definitely diagnosed. Certain clinical symptoms and unusual features described by the veterinary officers, together with unusual laboratory results, led to the suspicion that the disease might not be identical with that known as quarter-evil in other parts of South Africa and in Europe. This question was of some importance from the point of view of prophylaxis, for it was deemed unwise to make use of the vaccines protective against quarter-evil if the disease in this country was not identical, for in using them protection might not be afforded, but a new disease introduced. Experiments were, therefore, carried out by the Government Veterinary Bacteriologist, and it was demonstrated (1) that vaccine obtained from Pretoria conferred immunity against the local disease, and (2) that a vaccine prepared from local virus conferred immunity against Transvaal quarter-evil. These results proved beyond doubt that the disease was quarter-evil. In consequence of the doubt in the first instance as to the exact nature of the disease, it was not considered advisable to vaccinate the herds concerned, and they were moved to veld which had not been used for some time. The mortality soon ceased, and there was no re-appearance of infection for several years. In October, 1913, a solitary case was diagnosed on a farm in Umtali district. No further evidence of the existence of quarter-evil was forthcoming until December, 1916, when a gross infection was reported from a farm near Plumtree, rapidly followed by outbreaks throughout the district. The following May outbreaks were reported in the Matobo, Bulawayo, Umzingwane and Bubi districts, and before the end of the year it had appeared in the Insiza, Gwanda and Nyamandhlovu districts. In 1918 it appeared in the Belingwe, Selukwe, Gwelo and Chibi districts. In 1919 the spread was very rapid and extensive, the Salisbury, Lomagundi, Mazoe, Mrewa, Hartley, Marandellas, Umtali, Chilimanzi, Victoria, Charter and Melsetter districts becoming involved.

Thus within three years of its appearance on the western border at Plumtree quarter-evil, in a somewhat virulent form, had manifested its existence in practically every district in the Territory. There is, however, considerable evidence that the infection has always existed in Southern Rhodesia. Prior to 1916 a considerable mortality was reported from year to year amongst European and native-owned cattle

from what was alleged to be "snake bite." Now that quarter-evil is so well known to most stock owners, one hears of very few cases of death from "snake bite." Mr. H. M. G. Jackson, Superintendent of Natives, supplies the following notes in regard to its existence amongst native cattle, based on extensive enquiries made in several districts in Matabeleland:—

"Before the European occupation the disease was known. At the outset it was mistaken for snake bite, until the frequency of cases showed that to be impossible. It was known as *igazi* (blood), and by its Bechuana name of *isimakamaka* (meaning unknown). It also attacked goats and sheep in some seasons, when it was regarded as a distinct disease and called *magomenkula* (chooses the big or fat), the symptoms being identical with *igazi*. It was ultimately recognised as a manifestation of the same disease which might be infectious, and strict laws were made that no meat was to be carried away from where the animals died. The eating of the meat was permitted at the place where the death occurred, and the burying of bones and refuse was strictly adhered to."

In his annual report for 1919 the District Veterinary Surgeon, Umtali, says, in reference to the appearance of the disease in Umtali district in virulent form:—"Ever since I have been stationed in this district I have met with isolated cases of this disease, but the losses have always been very slight." One of the oldest farmers in Melsetter district informed the writer that he had odd cases of "sponzeikte," the Dutch name for quarter-evil, and similar information has been obtained from farmers in other districts. If it be assumed that the infection has always existed in this country, the question naturally arises, why should it suddenly assume a more virulent form and spread in the form of a mild epizootic? The following views were expressed by the writer in a note on quarter-evil which appeared in the *Agricultural Journal* for October, 1917, and subsequent experience has not caused any modification of them:—

"At the Veterinary Conference held in Bulawayo in 1913 I expressed the view that anthrax infection existed in Rhodesia to a considerable extent, that it had not been much in evidence since the Occupation because of the destruction of practically all the cattle by the rinderpest and later by Coast Fever, and that as cattle increased we would probably find anthrax manifesting itself. The same remarks apply to quarter-evil; in fact, I mentioned quarter-evil with anthrax.

"There is no doubt that quarter-evil has occurred in various districts throughout the country for several years past, the cause of death being attributed to snake bite, and I venture the following argument as to its assuming such serious proportions recently.

"Arloing, Cornevin and Thomas, distinguished French veterinarians, have stated that cattle raised in quarter-evil districts mostly contract the disease at a young age, becoming immunised early, by repeated absorption of small amounts of virus. Sir John McFadyean has expressed his opinion that this view is in conflict with

the observed facts in England, and suggests that cattle become more resistant, *i.e.*, the elimination of the more susceptible animals by disease gradually results in a type which is less susceptible, or more resistant, to infection, whichever way one likes to put it.

"Because of the inactivity of infection in this country for many years our cattle possess little or no immunity, or, alternatively, no increased powers of resistance, and when through some cause or other it becomes more active, or more accessible, they readily contract it, and to the ordinary observer the type of disease may, owing to the high mortality, appear more virulent than in areas where it is more generally or constantly present, and where stock owners are more familiar with it.

"Infection may have gradually increased. It may have suddenly increased because of climatic, telluric or other influences which cannot be determined, but from whatever cause, it found favourable conditions, *i.e.*, susceptible cattle.

"Quarter-evil is a disease connected with the soil, and transmission from animal to animal (as in contagious diseases) through intermediary objects rarely, if ever, occurs.

"The quarter-evil bacilli seem to be capable of multiplying in the soil, and through their resisting spores to preserve their capacity for development and infectiveness even under unfavourable conditions. That climatic and telluric conditions have some influence or effect in the growth and dissemination of such organisms cannot be doubted. It has frequently been observed in small enclosed grazing areas in the United Kingdom that a number of cases may occur one year, then an occasional case for a year or two, and may be after several years' absence a sudden recrudescence. The infection has been there all the time, and there must be some natural influence at work to result in such erratic manifestation of it. Another observation of some importance is that areas subject to occasional inundations are often heavily infected with quarter-evil.

"The conditions which have obtained in Matabeleland during recent years, *viz.*, a series of droughts followed by last year's heavy rains, may have been the actual cause of the widespread infection. To a certain extent a drought restricts infection, because all the bacilli and spores on the surface would be quickly destroyed by the rays of the sun. Those to which the sun's rays or air were not accessible would, of course, be preserved, and after the first rains would be brought to the surface by the new vegetation, or by washing away of the soil; the veld floods would carry them far and wide and establish new centres of infection. Further, every animal which dies establishes a new centre of infection, readily accessible to the rest of the herd, and it can readily be appreciated how infection may accumulate unless every carcass is destroyed. It is extremely likely that in many cases the heavy mortality has been the result of a cumulative infection, through leaving the carcasses to the vultures and jackals, or cutting them up and trading the meat to the natives."

It is impossible to estimate the losses from quarter-evil, as the existence of the disease and the mortality are not always reported to

the Department. During 1917 the mortality reported was 1,335 head, 1,104 the following year, and 1,075 in 1919. It may be taken for granted that the actual losses were far in excess of these figures.

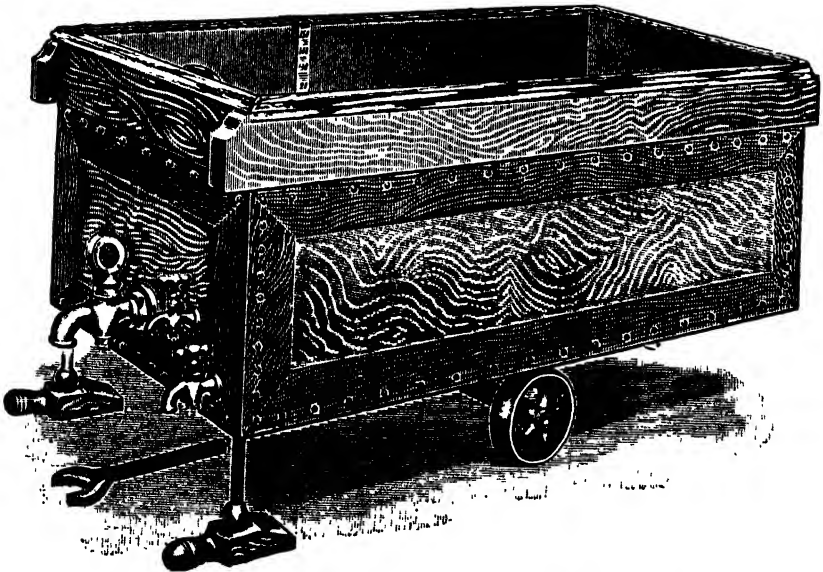
Whilst the disease was confined to the Plumtree district, quarantine was imposed on the infected farms, but as this seemed to have no influence whatever in restricting the spread of infection, it was discontinued. Vaccination was resorted to in most cases, and for some considerable time the results were in many cases disappointing. The vaccine used at this stage was the "single" and "double" powder preparations, obtained from Pretoria and London. The unfavourable results referred to may not have been due to any defect in the vaccines themselves, but to improper or careless injection. The powder does not mix readily with water, and unless the greatest care is exercised one animal will get a small part only of the dose, whilst another gets an excess. Needles of large calibre have to be used for administering this preparation, and if the needle is detached from the syringe after each injection the contents of the needle may be lost, thus reducing the proper dose very considerably. A too liberal use of strong antiseptics in cleaning the syringe and needle may also have had injurious effects by destroying the activity of the vaccine. Various other vaccines have been tried, but all have been discarded in favour of "Aggressin" and Leclainche and Vallee's liquid preparation, both of which have given uniformly satisfactory results.

(To be continued.)

Manufacture of Cheddar Cheese.

By T. HAMILTON, M.A., N.D.D., N.D.A., Dairy Expert.

Milk Required.—Milk for cheese-making must be pure and uncontaminated, as the keeping qualities and flavour depend almost entirely on the initial purity of the milk. Abnormal milk should never be used, *e.g.*, colostrum or milk from sick cows. Cheese-making will reveal the use of this milk very quickly; in fact, in some cases of abnormal milk rennet will not act. Highly flavoured food such as turnips or silage also transmit a taint to milk, and through the milk to the cheese. Bad water is another cause of taints in cheese, and it is essential that cows should have a pure and untainted water supply



Cheddar cheese vat, showing taps to let off hot water from the "jacket."

Treatment of Milk.—The evening's milk must be immediately cooled to a temperature of between 60 and 70 degrees. This can be done either by running the milk twice over a cooler or by constant stirring of the milk, the receptacle containing it meanwhile standing

in cold water. The temperature of the milk after cooling is a good indication of the degree of acidity likely to be developed during the night. The higher the temperature the higher the acidity, and *vice versa*. In the morning skim the cream off the night's milk and mix it with the warm morning's milk. If the weather is cold the cream should be heated so as to ensure a better mixture with morning's milk.

The " Starter."—A small amount of " starter " (or pure soured milk) should be added to the milk. The proportion varies according to the acidity (or temperature) of the milk kept over from the previous evening. The amount may vary from 1 oz. to 10 gallons of milk to 1 oz. to a gallon of perfectly fresh milk. The amount to add can only be learned by experience, but the general rule is to add just enough and no more to give a normally working cheese, *i.e.*, one in which the process of manufacture from time of rennetting to time of putting the cheese in the press is approximately five to five-and-a-half hours. The purity and activity of the starter is of extreme importance in cheese-making. Culture starters are essential if a large quantity of good flavoured cheese is to be made. These, in powder form, can be purchased from the leading dealers in dairy appliances. If, however, a small quantity of cheese is wanted, home-made starters from pure separated milk can be made, as described in the *Rhodesia Agricultural Journal* for August, 1920, page 342. The starter should be kept in a scrupulously clean, scalded enamel bucket. A good starter should have a smooth appearance and a sharp, pleasant, acid smell and taste. When it shows any trace of gassiness, or has an unpleasant odour, or when it becomes too acid, it should be discarded and a new starter propagated.

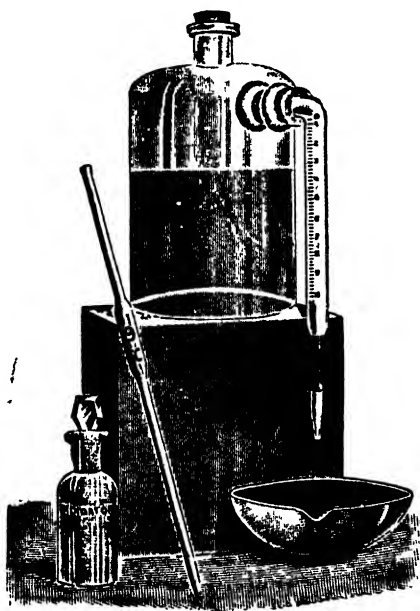
Preparation before adding the Rennet.—The morning milk is put in the vat after adding the starter, and the milk occasionally stirred up to keep the cream from rising. The temperature is then raised to 85 degrees, which is the average rennetting temperature. Usually the milk is allowed to ripen for one to two hours before adding the rennet. In this country, however, especially in the summer, the milk will generally be ripe enough for rennetting within half an hour after the starter has been added, if mixed milk (night's and morning's) is used. When only morning's milk is used the ripening period is at least one hour, but may be much longer if the activity of the starter has been impaired in any way.

Adding the Annatto.—Whilst the milk is undergoing the ripening process annatto should be added. The amount of annatto varies according to the depth of colour required. Usually for the light straw colour required in this country one dram (or teaspoonful) of annatto to 10 gallons of milk is sufficient. The annatto should be mixed with a cupful of water before being added to the milk.

Preparation of Milk for Rennetting.—It is essential to have the milk ripe enough before adding the rennet, and to ensure that sufficient amount of acidity has been developed various tests have been introduced.

The Rennet Test.—The only apparatus for this test is a watch

(with a second hand), a cup, a dram of rennet, a measuring glass and a teaspoon. Four ounces of milk are taken from the vat at 86 degrees F. It is essential that this degree of heat should be maintained, and to ensure this it is necessary to warm up the measuring glass with warm water, so that the milk will not be chilled. Measure out a dram of rennet into the cup and place on it a few pieces of the end of a burnt match, or particles of cork. These act as an "indicator." Pour the milk, the temperature of which is exactly 86 degrees F., rapidly on to the rennet, and stir vigorously with a teaspoon for five seconds exactly. Withdraw the spoon and watch the second hand until the pieces of match or cork cease to rotate. Usually with standard rennet and fresh milk the indicator ceases to revolve after 25 seconds, whilst if the milk is ripe enough for renneting the time should be from 19 to 21 seconds.



Acidimeter, showing burette for alkali porcelain testing dish, 9 c.c. pipette, and bottle containing indicator (phenol-phthalein).

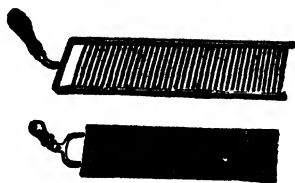
Acidimeter Test.—This test depends on the fact that an alkali neutralises an acid. The apparatus consists of a graduated burette containing an alkali of known strength. An indicator called phenolphthalein is used in the milk. A few drops of this are placed in a measured quantity of milk (9 c.c. when using a tenth normal solution of alkali). This does not change the colour of the milk at all, but as soon as an excess of alkali is run from the burette into the milk a pink tinge becomes apparent, and this tinge becomes a red colour when the acid in the milk is altogether neutralised. This red colour, of course, would show an excess of alkali. The milk should be care-

fully stirred as the alkali is dropped drop by drop into it. When sufficient alkali to neutralise the acid has been run in, a pink tinge should appear. The burette should be read, and the amount of alkali required to neutralise the acid in the milk registered. Usually two full divisions of alkali as measured on the burette will be required. This should show that the milk contains 0.2 per cent. lactic acid. It may be stated that the rennet test and the acidimeter test should be used in conjunction, as one checks the other.

Another test for ripeness in milk is afforded by Hansen's patent rennet test. This consists of a cup with a small aperture in the bottom. The cup is filled with milk and the temperature maintained at 86 degrees F. One cubic centimetre of rennet (diluted with water) is stirred into the milk, which is prevented from running through by the aperture being closed with the finger. After stirring for about one minute, the finger should be taken away from the aperture and the milk allowed to flow into a bowl held under the cup. Eventually the milk will coagulate sufficiently to stop the flow. The amount of milk which has run out will vary in inverse proportion to its acidity. The less acid the milk, the longer it takes for coagulation to take place, and *vice versa*. This rennet tester is a very reliable instrument if the rennet is of standard quality, and it should be a part of the equipment of all cheddar cheese-makers.

Adding the Rennet.—When the cheese-maker considers the milk ripe enough for rennetting, rennet in the proportion of 1 dram to 2½ gallons of milk (or 1 oz. to 20 gallons milk) is added. The rennet must be fresh and up to standard strength. A good deal of loss has been occasioned in recent years by the use of weak, old and improper rennet. If the cheese is not being made in large quantities, it is advisable to get rennet in small amounts to ensure the supply being fresh. Liquid rennet is to be preferred, although for cheese-making on a small scale rennet in powder form is often used with good effect. It is, however, necessary to have a guarantee that the powder rennet is new stock.

The liquid rennet is diluted with about 10 times its own bulk of water and well stirred into the milk for two minutes. The milk is then allowed to settle, and after five minutes have elapsed, the cream is lightly stirred down with a thermometer. The vat is then covered up with a clean cloth and the milk left to coagulate.



American curd knives.

Coagulation and Cutting the Curd.—Under ordinary circumstances coagulation should take place in from 35 to 40 minutes, and

should be complete, and the curd ready for cutting, when it splits cleanly over the finger or comes away from the side of the vat when pressed with the flat hand. American curd knives, both horizontal and vertical, are used, and the curd is cut into half-inch cubes. Cutting must be done as evenly as possible and the curd must not be bruised or injured in any way. When properly cut, the particles of curd will be of uniform size and the whey of a pale greenish colour. The curd is stirred by hand for about ten minutes, and the curd rake is then put in and stirring continued throughout the process of "scalding."



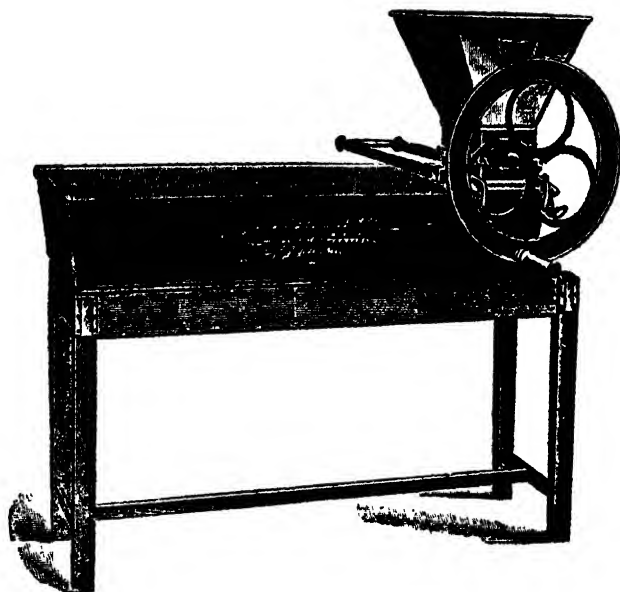
Curd breaker or stirrer.

Scalding the Curd.—After stirring with the hand and rake for about ten minutes, the temperature of the curds and whey is gradually raised by putting hot water into the jacket of the vat. The raising of the temperature to the maximum scald takes about 45 minutes, the first 30 minutes of which should be occupied in raising the temperature to 90 degrees. After this has been reached, the temperature can be raised more rapidly until in 45 minutes the maximum temperature varying from 96 degrees to 104 degrees F. has been attained. The maximum temperature varies according to the quality of the milk: the lower the butterfat percentage, the lower the scald, and *vice versa*. Stirring should continue throughout the process of scalding, and care should be taken to prevent the curd from settling into the corners of the vat. When the curd is firm, or when it is rubbery, or "shotty" as the cheese-maker terms it, stirring should cease and the curd allowed to fall to the bottom of the vat, in order to develop such an amount of acidity as to warrant the whey being run off.

Running the Whey.—This is a critical time in the process of cheese-making. If the whey is run off too early, the cheese-maker "parts with his best friend," whilst if too late the development of the acid becomes too rapid and gets out of the cheese-maker's control altogether. Premature action with regard to running off of the whey often results in a slow cheddaring curd, whilst the cheese itself in these circumstances is apt to be sour and sodden.

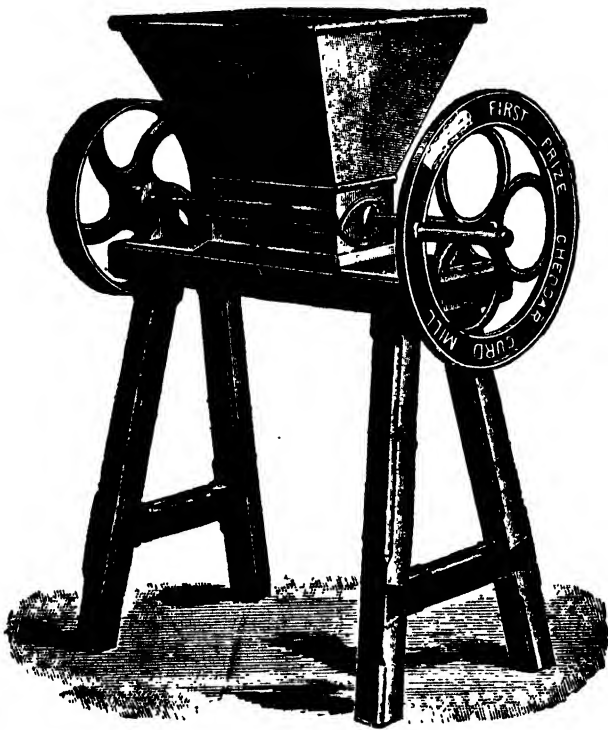
Various tests are in use for estimating exactly the amount of acid developed before running off the whey. These are, (1) the hot iron test, (2) the acidimeter test. The hot iron test is very reliable and simple. A piece of curd is taken from the vat and pressed between the fingers and palm of the hand until the excess of moisture is squeezed out. The curd is then dried on a clean cloth and rubbed lightly on a piece of flat iron just hot enough to brown and not to blacken the

piece of curd, which is then gently withdrawn from the hot iron. It will then be seen that thin, silky threads extend from the iron to the curd. It is the length and silkiness of these threads which help to show how much acidity has been developed. When the threads are a quarter of an inch in length, the acidimeter test should be taken. This should show at this time 0.22 to 0.23 per cent. acidity in the whey. When both the iron test and the acidimeter test indicate this degree of acid, the whey should be allowed to run. This drainage operation will be facilitated if the vat is tilted up.



Cooler and mill. The curd is placed on the cooler for cheddaring when large quantities of cheese are being made.

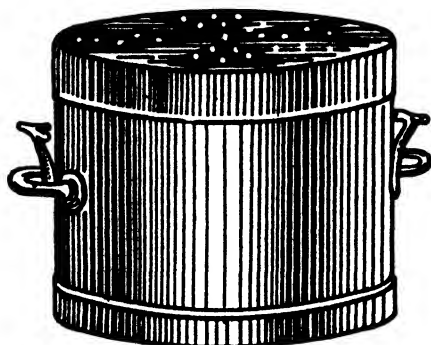
Cheddaring the Curd.—A channel should now be cut down the centre to allow of free drainage. If a large quantity of curd is being handled, it is advisable to cut it into pieces about nine inches square. The thickness should not be less than three inches. If a small quantity is being made, the curd, after being cut into squares, should be tied up in a cloth and kept warm. The cloth should be opened up every 20 minutes and the curd cut up and re-tied. A larger quantity of curd should be piled and turned every 20 minutes until the cheddaring process is complete. This will be indicated by the curd tearing in long fibres like the meat on the breast of a chicken, or by the hot iron test showing a fine, silky thread from one to one-and-a-half inches in length. The curd is then ready for milling.



Cheddar hand or power American curd mill.

Milling the Curd.—The curd is then put through a curd mill, or is cut into small pieces for salting. The milled curd should be well aerated to permit of the escape of bad odours and gases. Vigorous stirring with the hands aerates and cools the curd, which should be spread out and allowed to cool to 82 degrees F. before being salted.

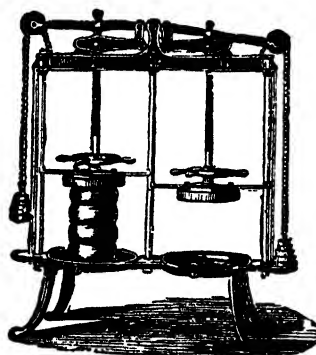
Salting the Curd.—Salt in the proportion of 1 lb. to 50 lbs. of curd; or 1 ounce to 3 gallons of milk originally used, should then be added and well stirred into the curd, which should then be piled and the salt allowed to dissolve from 15 to 20 minutes, when it is ready for putting into moulds.



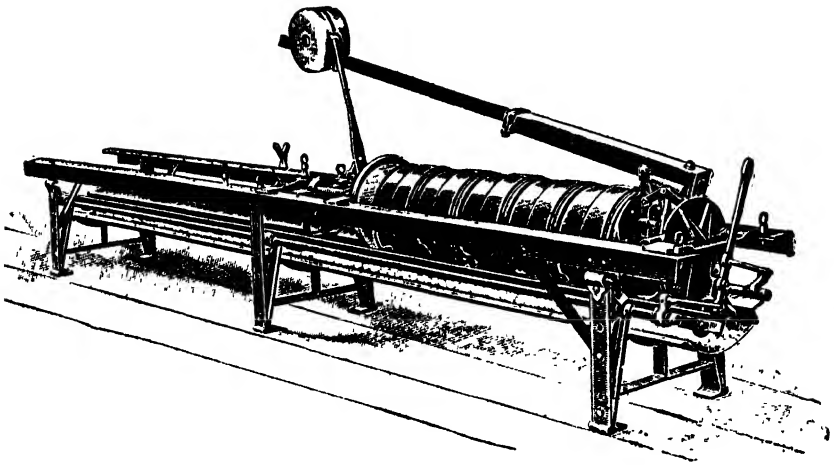
Australian pattern steel telescopic cheese mould recommended for Rhodesian use.

Moulding the Curd.—The type of cheese mould recommended for this country is the Australian steel, telescopic mould. This particular mould consists of two lids, a flexible steel lining, and a solid steel collar into which the flexible steel lining fits. A piece of tubular cheese bandage about 10 inches long should be cut and the flexible portion lined with it, with the surplus overlapping on the outside. The collar portion is then fitted on. The curd is pressed tightly into the mould, and the lid, into which a muslin cheese cap has been put, placed in position. The mould is then placed in the press and pressure applied.

Pressing.—Pressure should be gradually applied for the first hour. After this, maximum pressure, varying from 10 to 25 cwts., according to the size of the cheese, should be put on and maintained uniformly for 24 hours. The cheese should then be taken out of the press, removed from the mould and bathed in water at a temperature of 140 degrees for one minute. This will cause a closeness and fineness of



Cheese press, showing arrangement of levers to give continuous pressure.



Gang press for large factories.

rind, impossible to obtain by any other means. The bandage should be adjusted and trimmed, and the cheese returned to a clean mould, and placed back in the press. Pressure should be continued for another 24 to 48 hours, according to the size of the cheese.

Curing.—The cheese-curing rooms must be airy and cool. If properly constructed to exclude hot winds and direct sunshine, the temperature should not at any time exceed 70 degrees F. The doors and windows must be tightly fitting, and should always be placed on the south and east sides. If an insulated ceiling is provided, and doors and windows are kept closed during the day and thrown open during the early morning or late at night, it should be perfectly feasible to maintain an equable temperature throughout the cheese-making season.

The shelves should be kept clean and scrubbed with plenty of hot water and soda. Humidity is an important factor in cheese-ripening. Too much humidity means development of mould, whilst too little tends to excessive drying out of the cheese. In this country cheese made in the summer, when the curing temperatures are high, ripens rapidly, and may be sold at from five to six weeks. In the cooler months it should be kept for at least ten weeks before being sold.

SUMMARY.

1. Be careful to obtain *clean* milk for cheese-making.
2. If evening's milk is used, it must be cooled to a temperature of 70 degrees.
3. Skim off the cream from the evening's milk and mix it with the warm morning's milk.

4. Use an active, clean, smooth "starter," possessing a clean, sharp, acid taste and smell. Discard all gassy or fermented starters and propagate a new one.

5. Add annatto at the rate of 1 dram annatto to 10 gallons milk. Dilute the annatto with water.

6. Test the milk for acidity before adding the rennet.

7. When the milk is sufficiently ripe, add 1 dram of standard rennet to $2\frac{1}{2}$ gallons of milk. Dilute the rennet with ten times its volume of water and stir into the milk for two minutes. "Top stir" with a thermometer five minutes later.

8. Cut the curd into $\frac{1}{2}$ -inch cubes when the coagulum splits cleanly over the finger.

9. Stir with the hand for ten minutes after cutting.

10. Raise the temperature gradually (one degree every five minutes) for first half hour, and then more rapidly, until the maximum temperature ranging from 96 degrees to 102 degrees is reached.

11. Run the whey when the hot iron test gives threads between $\frac{1}{4}$ and $\frac{3}{8}$ inch in length.

12. Stir the curd after running the whey and allow it to cheddar.

13. Cut the curd into 9-inch blocks and turn it every twenty minutes.

14. Mill (or cut the curd into small pieces) when the hot iron shows threads of $1\frac{1}{2}$ inches.

15. Spread the curd out to cool.

16. Add salt in the proportion of 1 oz salt to 3 gallons milk originally used.

17. Pile the curd for 15 minutes, to enable the salt to dissolve.

18. Put into cloth-lined moulds, and press lightly in the press for an hour. Then put on maximum pressure.

19. Take out the cheese next morning. Bathe for one minute in water at a temperature of 140 degrees F.

20. Replace in mould and press for one or two days longer, according to the size of the cheese.

21. Cure in fly-proof curing insulated room at an average temperature of 70 degrees.

22. Sell at from five to ten weeks, according to the temperature of the curing room.

Irrigation Canals.

By A. C. JENNINGS, Assoc. Mem. Inst. C.E., A.M.I.E.E.,
Government Irrigation Engineer.

In this article it is proposed to deal with the location, design and construction of canals or furrows suitable for small irrigation schemes, and to indicate how these may be simply and efficiently constructed. In most cases it will be found advisable to seek professional advice as to its feasibility before attempting to carry out a scheme, as by so doing and by obtaining correct levels, unnecessary and costly mistakes will often be avoided.

Preliminary Investigations.—The first point that usually arises in considering a scheme is as to whether a certain piece of land can be brought under irrigation from an adjacent stream, and it is often an advantage for the farmer to determine this for himself before seeking any further advice. This can be done in an approximate manner, as follows:—First estimate the difference in elevation between the highest point of the land proposed to be irrigated and the nearest point in the river immediately below same, and call this vertical height (H). Then walk up the river and take a careful note of the drop of each small fall or rapid, until a point is reached where the total of such falls exceeds by one or two feet the first height (H). This will then be the theoretical point of intake, and a canal constructed from here upon a suitable grade would be able to command the land in question. In many of the small rivers of this country, especially in Mashonaland, the fall of the bed is about 25 feet per mile; thus for the irrigation of lands situated adjacent to, and not more than 25 feet above the river, it is seldom necessary to construct a canal more than about one mile in length.

Point of Intake or Diversion.—It will be realised that the foregoing method is only a very approximate one, and where the scheme is of any magnitude, correct levels should always be taken. In deciding upon the best point at which the water can be led from the river, consideration must be given to the width of the stream, height of its banks, the facility with which the canal can be constructed in order to quickly pass out of flood reach, and the nature of the river bed. In most cases the top of a waterfall or small rapid, at which a permanent ledge of rock crosses the river, meets the conditions and thus makes a suitable site for diversion.

Diversion Weir.—On many small schemes where conditions are favourable a weir not more than two or three feet in height will often suffice. In other cases it is sometimes necessary to raise the level of the river to a considerable extent in order to give the canal a suitable location. There are various types of diversion weirs, each designed to meet particular requirements, and as it is proposed to describe these in a subsequent article they will not be dealt with further here.

Main Canal.—The manner in which the canal takes its supply from the river is governed largely by local conditions and the type of weir adopted. On small schemes with a low weir, a common practice is to provide an outlet pipe in the base of the wall, as shown in figure 1. This pipe is then carried a short distance downstream and discharges into the head of the canal, the supply being controlled by a suitable sluice valve.

There is often some doubt as to the correct size of pipe required in cases of this kind, and in Table I. is given the discharging capacity for pipes of 3in., 4in. and 6in. diameter under heads of from 3 to 10 feet, the length (L) of outlet pipe being taken as 50 feet.

TABLE I.

Head (H) in feet.	3in. pipe.		4in. pipe.		6in. pipe.	
	Discharge in gallons per 24 hours.	Cusecs.	Discharge in gallons per 24 hours.	Cusecs.	Discharge in gallons per 24 hours.	Cusecs.
3	150,000	0·27	321,000	0·59	860,000	1·60
4	170,000	0·31	372,000	0·68	1,000,000	1·85
5	190,000	0·35	415,000	0·76	1,110,000	2·06
6	210,000	0·38	454,000	0·84	1,240,000	2·26
8	242,000	0·44	525,000	0·97	1,410,000	2·61
10	271,000	0·50	587,000	1·08	1,570,000	2·91

In setting out the first portion of the main canal below the intake one of the first considerations is to locate it so that it will be disturbed as little as possible by high floods, but there is often some difficulty in achieving this object. Where the banks are high it can be sometimes arranged to carry it back into higher ground for some distance, and a regulator constructed as shown in figure 2.

By closing the canal at the regulator, large floods, which are capable of doing considerable damage by depositing silt and scouring out

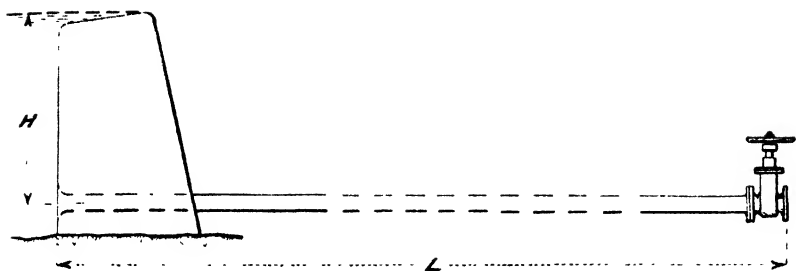


Fig. 1

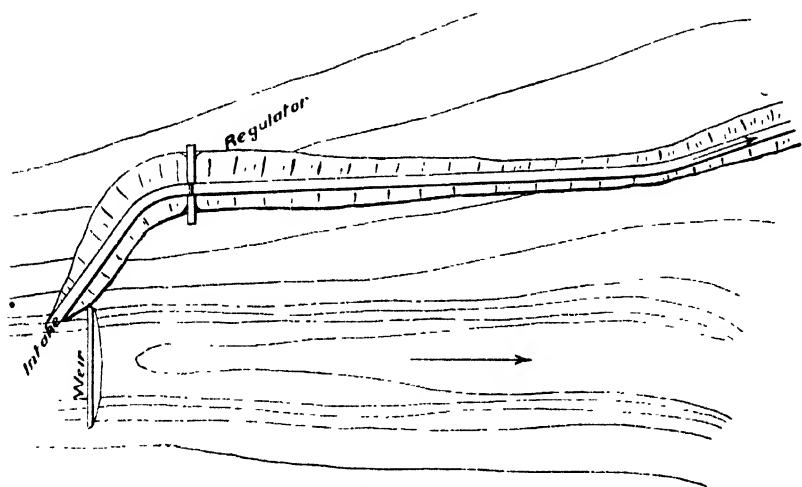


Fig. 2

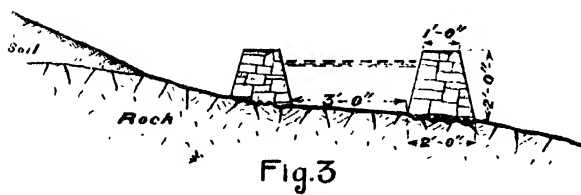


Fig. 3

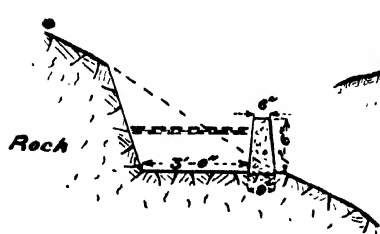


Fig. 5

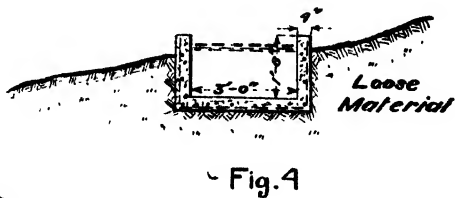


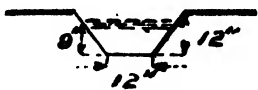


Fig. 4

the banks, are prevented from passing beyond this point. Where conditions are not favourable for an arrangement of this kind and the canal has to be placed fairly close to the river for some distance, it has then to be recognised that this portion will come under flood level, and is in consequence liable to be damaged. In many cases the damage may not be serious and can be repaired after each season's floods; but where it is likely to be considerable, steps should be taken to construct same in some permanent manner with masonry or concrete. A few typical lined or built up sections are shown in figures 3, 4 and 5.

The section shown in figure 3 can be efficiently constructed in uncoursed rubble masonry, using cement mortar proportioned 1 cement to 4 sand, the joints being faced with a richer mortar consisting of 1 cement $2\frac{1}{2}$ sand. The reinforced concrete work can be constructed of concrete proportioned 1 cement, 2 sand, 4 stone, the stone not being larger than 1 in. diameter. The steel reinforcement required will vary with the dimensions of the section, and detailed designs should be obtained before undertaking this class of work.

Capacity of Canals.—It may not be out of place at this stage to describe briefly the factors governing the carrying capacity of canals. The size of a canal is obviously governed by the volume of water it is required to discharge, and this in the case of the main canal is governed by the area of land to be irrigated. In the case of small schemes undertaken by the individual farmer this area seldom exceeds 100 to 150 acres, and usually a good deal less. Some misapprehension in this country exists as to the area which can be worked under irrigation on the average sized mixed farm, and it can be said that from 40 to 50 acres under cereals and mixed crops is usually as much as can be managed by one farmer in addition to his other farming operations. Where the area does not exceed 100 acres the main canal would not be required to carry a discharge exceeding about 3 cubic feet per second, and its dimensions would be proportioned accordingly, having due regard to the velocity of flow acquired by a given slope of the bed. A few typical earth sections giving the slope of bed, velocity of flow, and discharges, being illustrated in Table II. below:—

TABLE II
Canal Sections

<i>Section</i>	<i>Slope of Bed</i>	<i>Velocity in feet per Sec.</i>	<i>Discharge in Cusecs</i>
	$\frac{1}{1000}$	0.94	1.10
	$\frac{1}{1000}$	1.20	2.70
	$\frac{1}{1000}$	1.27	3.74
<i>Side slopes are 3/4 to 1 in each case</i>	<i>1 Cusec = 1 Cubic Foot per Second</i>		

The slope to be given to the canal bed is largely determined by the distance and the available fall between the intake and the lands to be irrigated, and varies in practice for small schemes from 1 in 500 to 1 in 2,000. Care must of course be taken that the velocity of flow will not be so high as to scour the channel, and thus a higher velocity can be given in rock than in ordinary earth cutting.

Setting Out and Construction of Canals.—It has been mentioned previously in this article that professional advice should be sought before proceeding with irrigation works of any magnitude, and this is especially necessary in regard to the alignment of the canals. In some cases, however, where the length is short and the work of a straight-forward character, the farmer can often "take out the levels" for himself, and the following is one of the methods which can be adopted :—

Method 1.—Construct from a few lengths of flooring board an A frame having a span of about 10 feet, as illustrated in figure 6. Then to adjust the A frame ready for starting work, place the feet on a level surface and note the position of the plumb bob by a mark on the cross bar. Then reverse the frame end for end, and if the feet are not exactly level, the plumb bob will swing to a new position, which should be again marked. A point midway between these two marks will then

be the zero position of the plumb bob, at which it should hang when the feet are on an exactly level surface.

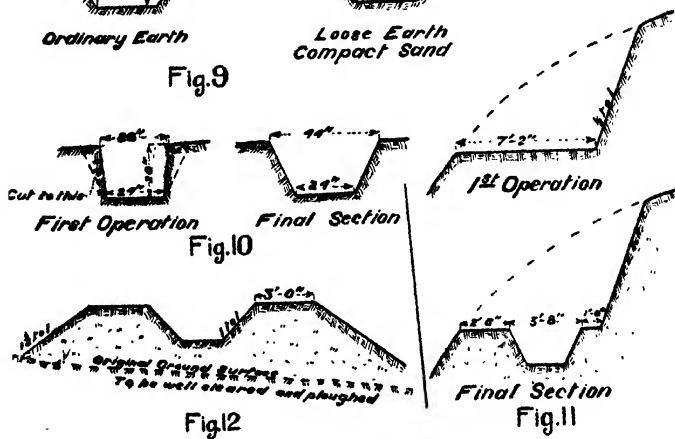
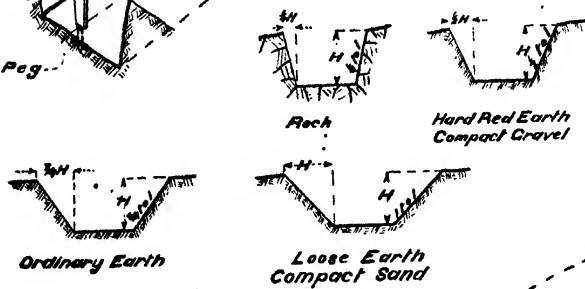
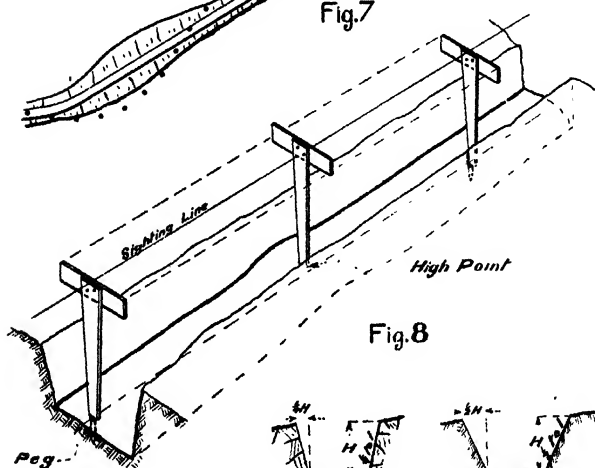
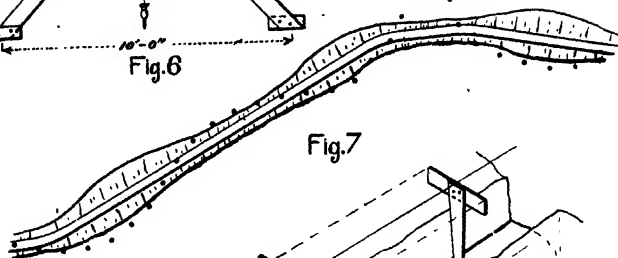
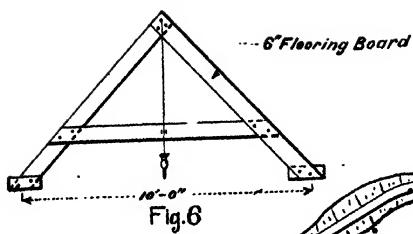
In commencing operations, start at the upper end of the work at a point where the ground surface is about the required depth above the canal bed. Then drive in two pegs about in the alignment of the canal, calling the upper one nearest the intake A, and the other one B. Place the A frame on these pegs and drive in peg B until the plumb bob hangs in the centre. Assuming now the slope to be given to the canal bed is to be 1 foot per 1,000 feet, which equals $\frac{1}{8}$ inch per 10 feet, then the bed at peg B will be $\frac{1}{8}$ inch lower than at peg A.

Now make a mark on B exactly $\frac{1}{8}$ inch below the top, and saw off the peg exactly at this mark. Continuing downstream, a further peg C is driven in and the frame held on B C and again levelled, by adjusting the peg C, which is then cut off $\frac{1}{8}$ inch as at B. If the depth of the canal is required to be 24 inches at A, it will be uniformly 24 inches at all the remaining pegs, as the adjustment for grade has already been made by sawing off the pegs. The work of pegging should be continued in as straight lines as possible, but where owing to the uneven nature of the ground the pegs are found to come very irregularly the final alignment can be made slightly above or below the pegs as shown in figure 7, and a somewhat deeper cut made here and there, but this, of course, will not affect the uniform depth measured from the pegs.

In small canals the depth of water to be carried will not usually exceed 1 foot, and in these cases the bed will be about 1 foot 6 inches below ground level.

Method II.—The next method to be described is that where a canal has been first located by an engineer and pegs placed on the alignment at each 100 feet. In such cases the farmer is provided with a complete list giving the depths of the bed at each peg. The pegs thus placed can be taken as centre line pegs unless otherwise stated, and in carrying out the work it is a good plan to first excavate a pilot hole at each peg and place a small peg in the bottom with its top at the correct grade level of the canal. The trench is then excavated to the correct depths, and the bed evenly graded between successive pegs. This latter operation can be easily performed by "boning rods" cut about three feet in length and used as shown in figure 8.

Side Slopes.—A very important operation connected with the construction of any canal is the provision of the requisite side slopes. As will be generally known, practically all material has its own angle of repose, upon which it will naturally stand, and if a trench is cut with sides too steep they will invariably cave in. As a guide in this matter the typical sections illustrated in figure 9 indicate the minimum slopes which should be given for different materials. In making the excavation the best practice is to first cut the centre trench a little wider than the bed width and then set out the side slopes and trim these neatly back. The matter is more clearly explained by reference to figure 10. In this furrow the depth is 20 inches, therefore if the side slopes are to be made, say, $\frac{1}{2}$ to 1, then they will recline 10 inches from the vertical



on each side, and the top width will be 24 inches plus 10 inches plus 10 inches, equals 44 inches. In setting out the final top width on the surface before cutting the slopes, it will be found that the width will vary from peg to peg according to the depth. This, however, is perfectly correct, and the finished result should be a neat uniform slope throughout the canal. In sloping ground all material excavated should be thrown on the lower side of the canal, and a berm of at least 1 foot width left between the top of the canal slope and the toe of the spoil bank.

Canals in Steep Hill-sides.—It frequently happens that a canal has to traverse the side of a steeply sloping hill, and in such cases it is often found expedient to first cut out a level bench and then excavate the canal in this, close up under the slope, as shown in figure 11. In heavy cutting of this nature the slopes should be ample to ensure the face of the excavation standing without slipping, as is likely to occur during or after heavy rains. The provision of a storm water drain at the top of the slope above the canal is often desirable and necessary in cases of this kind.

Double Bank Canals.—In the works so far described the canal is a simple excavation, that is, it is cut in the solid ground. In many cases, however, it is necessary to carry the water supply of the canal partly or entirely above ground level, and in such cases double bank canals are constructed of the types shown in figure 12. All work of this kind must be constructed of selected earth material, and thoroughly well consolidated during placing. It is desirable that any large works of this type should be set out by an engineer before construction.

Napier Fodder.

We have on various occasions published in this Journal extracts from reports and articles which have appeared in the agricultural press of Australia on the subject of Napier fodder. This grass has been extensively tested there, and the following extracts from an article written by E. Breakwell, B.A., B.Sc., Agrostologist for the *Agricultural Gazette* of New South Wales, July, 1921, will be of interest:—

" Since the last article on this grass was published in the *Agricultural Gazette*, December, 1919, a good deal of further information concerning it has been obtained, and the time may be said to have arrived when it should be dealt with more freely, and the results finalised which have been obtained by the Department and by over 100 farmers who have reported on it in different parts of the State.

" As a proof of its wonderful aptitude for growing on poor country, it may be mentioned that some coastal land just south of Newcastle previously devoted to burrawang and useless scrub has now elephant grass growing there in abundance, providing a considerable amount of good feed. The appearance of elephant grass is extremely deceptive. At first sight it looks unpalatable, but that it is not so is proved by official investigations under varying conditions, and also by the numerous reports submitted by farmers. Elephant grass is not so palatable as many other well-known grasses, but that cattle will eat it and do well on it is beyond question. Its palatability appears to be greatest in its young, more succulent stages. When it reaches a height of 7 feet or over, its woodiness is against it, though even under these conditions the softer ends of the stalks and leaves are readily eaten. Sheep appear to like the grass least of all when other grasses are about, but they will eat it and thrive on it when other feed is not abundant.

" At Hawkesbury Agricultural College the milk and butter-fat records of eight cows were taken while they were feeding on the elephant grass, and also during occasional periods when they were taken off the plot and allowed to graze on the natural pastures. These recorded twenty-eight milkings while the cows were feeding on the grass, and fifty-five milkings while they were off. The results appear sufficiently conclusive that the milk yields and butter-fat tests are maintained on elephant grass. It might be added that the ordinary pastures of the College were in very good condition at the time the test was carried out."

The article concludes with the following appreciative remarks in regard to the carrying capacity of the grass:—

" A fodder that will produce 70 to 80 tons of green feed per acre in a season must necessarily have a good carrying capacity. It is very difficult to obtain the actual carrying capacity of the grass, owing to it having to be fed off at intermittent periods. It may be said that when six feet high it requires to be very heavily stocked to ensure it being eaten down. The cows should then be removed until the grass has made new growth. In the winter months no growth is made, but during the summer elephant grass will maintain ten to twelve cows per acre at periodical intervals."

It is only right that the other side of the question should be given, and we therefore publish the following table of analyses which appeared in the *Queensland Agricultural Journal* for July, 1921:—

	Moisture.		Crude protein.		Carbo-hydrates.		Crude fibre.		Crude fat.		Crude ash.		Ratio, nutritive.		Lbs. of fodder to give	
	%		%		%		%		%		%		Ratio, nutritive.		Lbs. of fodder to give	
Elephant grass :—																
2 weeks old	85.5	2.1	6.4	4.3	.10	1.6	1 : 7.4	132	183	lbs.	lbs.	Starch, 11 lbs. of.	Protein, 1.9 lbs. of.		
4 weeks old	83.5	1.3	6.6	6.1	.14	2.4	1 : 14.0	75	297	lbs.	lbs.				
8 weeks old	78.1	1.7	9.2	7.4	.23	3.4	1 : 14.3	73	229	lbs.	lbs.				
Mature	73.1	1.4	11.6	11.9	.19	1.8	1 : 23.2	46	268	lbs.	lbs.				
6 months old (sticks up to 14 feet long)	...	70.0	1.0	13.8	13.2	.20	1.8	1 : 37.7	29	380	lbs.	lbs.				
Couch grass	74.1	4.1	10.0	8.4	.4	3.0	1 : 5.5	71	79	lbs.	lbs.				
Sorghum	70.6	2.1	15.1	9.1	.6	2.5	1 : 17.9	58	158	lbs.	lbs.				
Lucerne hay	8.2	21.0	31.4	25.9	2.8	10.7	1 : 3.3	24	17	lbs.	lbs.				
Linseed meal cake	...	10.0	36.1	36.7	8.4	3.6	5.2	1 : 1.4	16	6	lbs.	lbs.				
Pollard	10.0	17.4	58.0	5.2	5.6	3.8	1 : 4.3	15	14	lbs.	lbs.				

The analyses given show that only very young Napier fodder can be classed as fodder of fair quality. The primary value of Napier fodder does not, however, lie in its actual feeding value, but rather in the great weight of succulent fodder which it produces annually, and in the fact that it will thrive on poor land, will withstand drought to a remarkable extent, and in this country, if well treated, will produce without irrigation a luxuriant growth of green feed in early spring before the rains break.

The following is extracted from *Hoard's Dairyman*, 3rd February, 1922:—

Mr. Gratz Dent, county agent of Chatham County, Georgia, has this season observed and checked the harvesting of 62 tons of Napier grass from one acre of land, the determination of the yield being made on the basis of the capacity of the silo. He does not claim that it was dry weight but green weight, or rather that the grass from one acre of land filled up a 62-ton silo. The silage was finely cut; it contained considerable stalky material and was well packed before the estimate was made.

And what is Napier grass?

Napier grass is a native of the tropical Africa developed by the Rhodesian Department of Agriculture. It was introduced into this country by the United States Department of Agriculture in 1913, and experiments were started with the grass by the Florida Experiment Station in 1915. It is stated that it is adapted to all of Florida, to the gulf coast in general, and to coast lands possibly further north than Savannah.

The grass is rank growing, as one may well guess from the phenomenal yield recorded. It attains a height of 15 to 18 feet, and generally averages between 6 and 15 feet. It is a cane-like perennial, quick growing, each branch bunching or tillering into many other branches, each bearing numerous broad, succulent leaves. If the plants are set far enough apart, under favourable conditions, a single plant will develop a hundred or more stalks and under average conditions a dozen to two dozen stalks are formed.

Unlike some other transplanted tropical plants, Napier grass forms seeds. It develops millet-like seed spikes varying from 4 to 10 inches in length. Branches of the main stalk also produce seed, and it is not uncommon for a single cane to have ten or more seed heads. Of course the seed adds to the feeding value of the silage.

The Florida Experiment Station has analysed Napier grass for its feeding value, comparing it, in its green fodder form, to corn in the green stage, the results being as follows:—

	Corn (Maize). Per cent.	Napier grass. Per cent.
Water	78.1	61.81
Ash	1.2	2.92
Protein	1.9	2.92
Carbohydrates	13.0	17.29
Fat ... . . . .	.6	.29
Fibre	5.2	14.77

The palatability of Napier grass ranks high. According to claims put forth by the Florida Station Bulletin 153, it is surpassed by no non-leguminous hay. As silage, Napier grass has not been tested scientifically. It is non-saccharine, and therefore considered superior to sorghum as silage material.

The experiment station data referred to in the Florida bulletin treat of Napier grass in its green state and as hay. In fact, it would seem that, notwithstanding its phenomenal yield of silage, Napier grass is better adapted to the production of hay, since it is possible to cut two to three crops a year of Napier grass four to five feet high. As the grass grows to maturity the stalks become hard and contain a high percentage of woody fibre.

Napier grass can be propagated from either seed or cuttings. It grows well on poor soil and gives a heavier yield than any other grass on all kinds of soil in the Gulf regions. It responds readily to fertilisation. Much, indeed, is expected of Napier grass as a live stock asset of the South. Its development is as yet in its infancy.

The following extract is taken from the Bulletin of the Imperial Institute, Vol. XIX., No. 2, 1921:—

“Elephant Grass—*Pennisetum purpureum*, Schumacher (= *P. Benthamii* Steudel), known in Rhodesia as ‘zinyamunga’ or ‘Napier fodder,’ is a tufted perennial grass with culms reaching 6, 10, or even 20 ft. in height and an inch in diameter at their bases, which abounds over a wide range between 10 degrees north and 20 degrees south in tropical Africa, both west and east, along water-courses, in marshes, forest, and reed jungles, and in a smaller form reaches altitudes of 5,000 to 6,000 ft. In the drier parts, as on the savannahs of East Africa, it seldom grows to a greater height than 6 ft. In appearance it resembles a slender bamboo, and the mature stems are very hard. It has been stated that not less than 10 per cent. of the land surface (*i.e.*, 6,500,000 acres), and possibly 30 per cent., is under elephant grass in Uganda. It grows rapidly after being cut, so that there seems no reason to suppose that it will suffer from repeated cutting. It has been calculated that two crops could be cut annually, yielding a total of 60 tons of dried grass per acre, from which 25 tons of pulp could be obtained.

“A sample of the dried mature grass from Uganda was sent to the Imperial Institute in 1912 for examination as a paper material and further experiments were made in 1916. The ultimate fibres were found to average 0.08 in., *i.e.*, longer than those of esparto, but shorter than those of bamboo; and the numerous nodes were not found troublesome, as they were stated to have done in Togoland. Though it was considered that the grass would not obtain a higher price than average esparto, and in view of the higher cost of transport could not therefore be profitably shipped to Europe, it was thought that

pulp made in Uganda would equal soda wood-pulp in value (this Bulletin, 1913, 11, 68). The favourable results obtained on a laboratory scale have been confirmed by a large-scale trial conducted at a paper-mill in the United Kingdom, and the material has since been used for Government printing paper in Uganda and appears quite satisfactory. The paper is tough, of good colour and fine surface, taking either writing or printing ink well.

“ *General Conclusions.*—In some cases, as that of elephant grass in Uganda, grasses might satisfy a local demand, and leave a margin for the manufacture of pulp for export; in every case it is necessary that the grass should be converted into half-stuff in the country of origin, as, under present conditions, the raw material would not realise a sufficiently high price in Europe to allow of the cost of transport.”

Poultry Husbandry.

HOUSING AND FEEDING OF ADULT FOWLS.

By A. LITTLE, Poultry Expert.

The housing and feeding of adult birds, i.e., birds kept for market, eggs, and for breeding purposes, are quite different to those required for chicks and growing stock. The object of feeding the former is to produce eggs and stamina and to compensate for wear and tear and energy expended; in the case of chicks and growing stock sufficient food has to be supplied to produce constant growth of bone, flesh, fat, feathers, strength and vigour, and to compensate for wear and tear and energy expended. This is a point that many poultry keepers do not realise, and frequently over-feed their adult stock and under-feed their growing stock. On the other hand, the main principles of housing applies to both, viz., the maximum of fresh, pure air without draughts in the houses day and night; the maximum of light in the houses, and especially sunlight; watertight roofs, dry floors and elimination of dampness are absolutely essential.

Site of the House.—This should be if possible on rising ground; to place a house in a hollow is to court trouble. The back should be towards the prevailing wind and rain, and the front facing any point of the compass between east and west; there is nothing in the old idea that it should face the rising sun; the main point is that as much sun should shine into the house as possible. The soil on which it is placed should be sand, light loam or gravel; in fact, one which is well drained and dries quickly after rain.

Material.—Any material which the poultry keeper finds it easiest and cheapest to obtain will suffice, provided good work is put into the building, but the following are in order of merit:—Pisé à terre (well made), brick, concrete, Kimberley brick, wood, iron, pole and daggas and grass. Pisé à terre 6 ins. to 9 ins. thick, plastered inside and out, and with a good coating of lime wash, is an ideal material, giving a very even temperature, cool in summer and warm in winter, and with no sudden rise during the day and fall at night. The same applies almost equally to concrete, Kimberley brick and ordinary brick. Both the latter must have care exercised in the plastering or pointing to eliminate all cracks in which insects, especially fowl ticks, can find harbourage. Wood in this country is usually too expensive; further, it is difficult to obtain well seasoned timber. If it is used, it should always be well painted before being erected with some creosote

preparation to preserve it from the ravages of white ants and to eliminate all insect vermin. Iron is good up to a point, but it must not be thought—as generally seems to be the case—that by using it elimination of insect vermin is secured. These are often found in the overlaps in large numbers. One advantage of an all-iron house is that it can be periodically half filled with dry grass, to which a light is set, and heated almost red hot. If such a house is erected it should be covered on the sides, the back and roof with grass to ensure as even and cool a temperature as possible. A very good, cheap house can be made with pole and dagga, but needless to say the work must be good and the walls well plastered and free from cracks; such a house ensures a cool, even temperature.

A grass house, too, if well made and covered either inside or out with wire netting to prevent cats, etc., obtaining ingress, answers the purpose very well. It is inexpensive, comfortable, and can be burnt down periodically, and quickly and easily replaced. The material used for the roof of any of the above will naturally be either iron or thatch; the latter is the better, provided it is watertight, for the reason that it is cooler in the hot weather and warmer in the cold, and less expensive than iron.

General Construction of all Poultry Houses.—Naturally, economy with efficiency should be studied in the erection of poultry houses, and the lean-to type has been found to meet all requirements. The main points are convenience, e.g., the cleaning of them should be quickly and easily accomplished; they should be high enough to prevent stooping when inside them, and all fittings should be movable; dryness, airiness and durability; all, whether breeding houses, laying houses and those for growing stock, should be built on the same general plan.

Breeding Pen Houses.—A 6 ft. square (inside measurements) house is of sufficient size for a breeding pen of fifteen hens and a cock, giving ample perch room and scratching room. The old idea of allowing so many cubic feet space, or so many square feet floor space to each bird, was necessary when the only ventilation was a louvre or two, and a trap door through which the birds had ingress and egress; now, with the open fronted wire netting house, this does not hold good. The height in front from floor to eaves should be $6\frac{1}{2}$ to 7 ft. and at the back $4\frac{1}{2}$ to 5 ft. The roof on all sides should have an overlap of at least 1 ft. The front should consist of a solid wall 2 to $2\frac{1}{2}$ ft. high, and above this to the roof, wire netting, and at one end of this a wire netting door. The wire netting front and door are absolutely necessary in order to confine the birds during wet weather, to ensure safety at night from marauders (both two-legged and four-legged), and to catch more easily the birds when required to do so.

The floor is one of the most important points to be studied in the erection of a poultry house. Upon it depends greatly the health and productiveness of the birds. If soft and dusty, it is difficult to clean well; sand fleas lay their eggs in the dust and soft earth, and these are continually hatching out, and the poultry keeper finds that, no matter how often he eliminates them from the heads of his fowls, others the next day take their place. If not above the level of the ground

outside the house, it will in wet weather always be damp, and a damp floor is the precursor of diseases of all kinds. Therefore, the floor should be made of concrete, ant heap or some other hard material, and perfectly level, without cracks, and 2 ins. above the outside ground.

The Laying House.—This can be of any size, from 6 ft. square upwards, built in exactly the same manner as the breeding house. It can be of any length, according to the number of laying birds it is required to house; there are some in this country at present 200 ft. long holding 450 birds. If more than 15 ft. long, it should be 7 ft. deep, but no house however long should be more than 12 ft. deep, otherwise the air at the back is not too good nor pure. To prevent a draught sweeping through big houses from end to end, it is necessary to erect thin partitions every 20 ft. or so, high enough only to reach slightly above the heads of the birds when on the perches.

Interior Fittings.—These should all be movable, as plain and simple and as easily cleaned as possible. Perches should be all on one level, $2\frac{1}{2}$ ft. from the floor, and run from side to side of the house, the rear one $1\frac{1}{2}$ ft. from the back wall and a distance of 1 ft. between the others. If dropping boards are used, these should be 4 to 6 ins. below the perches, thus allowing the whole of the floor space available for the birds to scratch in the litter, which should cover the floor to the depth of at least 1 ft. If dropping boards are not used, the floor space underneath the perches should be divided off by a brick or wooden partition 2 ft. high, and within this the floor should not carry litter, to facilitate the cleaning up of the droppings each morning, the scratching litter being only on the floor between the above-mentioned partition and the front of the house.

The nest boxes, which should also be movable and easily cleaned, should be on a platform $2\frac{1}{2}$ ft. from the floor, as should also the receptacles for water, milk, dry mash, grit, charcoal and oyster shell, with the object again of giving as much floor space for scratching as possible, for the greater the scratching space, the greater the number of birds can be accommodated in the house.

Runs.—The size of these is immaterial, for such are only necessary in order that the birds may come out of the houses for a little additional fresh air and not for exercise, this being obtained by scratching in the litter inside the house. A run 20 ft. long by 12 ft. wide is ample for 30 birds, and one 30 ft. long by 15 ft. wide for 60, and so on. Like the floor of the house, it can be kept cleaner and more hygienic if level and hard and lightly swept each day with a soft broom or leafy branch to remove the droppings, loose feathers, etc., etc.

For the heavy breeds, 4 ft. wire netting is high enough; for the light ones, 6 ft. is necessary. In each case it should be sunk below the level of the ground 2 to 3 ins. This is preferable to pegging down; pegs are apt to become loosened, and the birds burrow their way out.

In all cases the houses and runs should be as clean and neat as possible; nothing looks worse and is less conducive to productiveness and health than dirty, untidy houses and runs, standards crooked, wire netting uneven and sagging. It will always be found that the

houses and runs of the successful poultry keeper are the essence of neatness and cleanliness. All water and milk, etc., utensils should be neat and clean. Excellent ones can be made from paraffin or Mobiloil tins, small packing cases, etc., at little cost, certainly at far less than those that are bought ready made.

Feeding.—No hard and fast rule can be laid down for feeding. For instance, for birds in pens the menu is quite different from that for birds running on free range. The latter, if they have access to cattle kraals, stables, etc., require little or no food given to them; they manage to obtain the food they require for all purposes and balance their own rations. It is quite a different matter for birds kept continually in houses and small runs; all the food required for different purposes has to be fed to them, and their rations for the day more or less balanced for them.

Birds in Pens.—The main points in feeding to remember are that fowls, to produce well and keep in good health, require green food in abundance, thick milk or some meat food, grain and meals. The two former are the most important; thick milk is health-giving, is beneficial to digestion and a producer of eggs; if this is not available, animal protein in some form (e.g., meat meal, fish meal, insects) is necessary. Green food also is absolutely essential for the production of eggs, size of eggs, and for health; any kind, provided it is succulent and not too fibrous, is suitable, as, for instance, sunflower leaves, banana leaves, cabbages, lettuce, lucerne, pigweed, wild spinach, sprouted oats or barley, etc. It should always be cut up in small lengths of $\frac{1}{2}$ to 1 in. and placed in clean receptacles, but never thrown down in the run in large pieces. Every grain should be fed in deep litter in order that each should be scratched for; such scratching exercise ensures continuous health and well being, and is conducive to many more eggs.

The feeding of poultry should be as plain and simple as possible. The food given should be of as good quality as possible consistent with economy. The dry food system, in my opinion, is the best for laying and breeding birds and for growing stock. It is more conducive to health and vitality than the wet mash system, and is quite as productive of eggs. For the purpose of fattening, the wet mash system is the best. Regularity in feeding is most important; no sudden changes must be made in this respect, otherwise the egg yield suffers very materially.

The balanced ration for the day should work out at from one part of protein to every $4\frac{1}{2}$ to $5\frac{1}{2}$ parts of carbohydrates; it will be noted that this is for the day. There is no necessity for each meal to be a properly balanced ration, for the birds themselves will balance their own rations, given the opportunity. For instance, the day's menu at the egg-laying test is as follows:—At 7 a.m. to every five birds are given two good handfuls of munga (inyouti) in their scratching litter, followed immediately by a quantity of cut green food. At 11 a.m. they receive as much separated thick milk as they can drink; at noon two handfuls of dry meal to each five birds, consisting of the following: Mealie meal, 6 parts; bran, 1 to 3 parts (according to the price);

ground nut meal, 1 part; and if no thick milk is available, fish or meat meal, 2 parts (all by measure); pea or bean meal can be substituted in the same proportion for nut meal if it is cheaper. Care should be taken to see that the bran is of good quality. At 4.30 p.m. one good handful to each bird, again in the scratching litter, on successive days, of crushed mealies, munga and small black sunflower seeds, and on the fourth day one handful to each bird of a mixture of equal parts by measure of these three grains; followed immediately by again as much cut green food as the birds will eat. Such a menu is economical and conducive to health, vitality and productiveness, and the birds eat enough of each to balance their own rations. Crushed kaffir corn can be substituted for mealies; crushed peas, beans or ground nuts can occasionally be substituted for sunflower seeds, buckwheat for munga, depending always upon what is available or cheapest at the moment. Rapoko should never be given to breeding or laying birds, for it is much too fattening.

If a large number of birds are being run together it is advisable to have a number of receptacles containing the dry food always before the birds, but care must be taken to prevent them eating too much and becoming fat; if this happens, it should be taken away for part of each day. Of course, clean, fresh, cool water should always be before the birds, as well as hard, sharp grit, charcoal and oyster shell, sea-shell or well slaked lime.

Feeding Adult Birds on Free Range.—Birds on free range which have not access to cattle kraals, pig sties or stables, should receive at midday half a handful of grain in scratching litter and one handful at sundown; also once a day, preferably in the evening, cut green food; thick milk and clean water also should be handy. It is advisable also to supply grit, charcoal and shell. Birds on free range that have access to stables, cattle kraals and pig sties require little or no food given to them beyond perhaps a handful of crushed mealies to every four birds at sundown, and some cut green food. Frequently birds running under these conditions obtain too much food and become too fat, with the result that eggs are less in number; if this is the case, the only alternative is to run more fowls on the same area, and so lessen the amount of food each is able to obtain, resulting in healthier birds and more eggs.

The poultry keeper would do well to remember that there is no hard and fast rule with regard to either the quantity or kind of food to be given to his fowls. He must use common sense, and note always the condition of his birds, whether they are too fat, too lean, whether eggs are produced in quantity or otherwise, whether the birds are receiving food for the production of eggs and health or otherwise, and act accordingly. The man who on every occasion gives exactly the same sort of food and quantity, irrespective of conditions, will not obtain the best results. The birds should be watched and methods changed when necessary, but this should always be carried out gradually. If the birds are doing well, always leave well alone, and never chop and change for the sake of experiment, as many are often apt to do.

Treatment of Tobacco Seed against Wildfire and Angular Spot in Southern Rhodesia.

By D. D. BROWN, Assistant Tobacco Expert.

Owing to the damage done to the tobacco crop by wildfire and angular spot, caused by *bacterium tabacum* and *bacterium angulatum*, treatment to minimise this damage has been found necessary. The tobacco seed is treated with a solution of either formaldehyde or perchloride of mercury, the former being most generally used. This solution is made up as follows:—

40 per cent. formaldehyde	29.5 c.c.	} English fluid measure.
water	473 c.c.	

To treat one half-pound of tobacco seed double the above-mentioned quantities will suffice. As soon as the solution is prepared in a suitable utensil the seed is poured in and the contents well stirred for a period of fifteen minutes. It is highly important that the tobacco seed be removed from the formaldehyde solution after exactly fifteen minutes' immersion. A shorter period may prove ineffective in destroying all the bacteria which might be present, while a longer period has an adverse effect on the germinating power of the seed. In order to remove the seed from the solution it is best to pour the contents of the utensil into a muslin bag, the mesh of the fabric being fine enough to hold the tobacco seed, while allowing the solution to run through freely. If the bag used for washing the seed in is too closely meshed more time and water will be required to clean the seed. After this has been done it is necessary to wash the seed with water until all traces of formaldehyde solution have disappeared. Too much emphasis cannot be laid upon the fact that tobacco seed must be thoroughly washed after treatment. It has been found that it requires between 20 gallons and 32 gallons of water to thoroughly wash one half-pound of seed, a big rush of water not being so effective as a lesser supply, say, through $\frac{1}{2}$ in. pipe. Where there is need for economy in use of water, it would be advisable to wash the one half-pound of seed—after the solution has been strained off—with eight gallons of water. The seed is then placed in the sunshine and allowed to stand there for at least one hour. During this period a lot of the formaldehyde will evaporate. A further washing with about eight gallons of water should then free the seed from all traces of the solution. It is not advisable to treat

and wash more than one half-pound of tobacco seed at a time, a larger quantity than this being difficult to deal with properly. After the seed is free from all traces of formaldehyde, it is spread out in the sunshine to dry. Sheets of strong brown paper are quite suitable if no trays are available for drying the seed on. These should be placed in a spot sheltered from the wind. The bag containing the seed is taken and swung round for a few minutes in order to get rid of as much of the water as possible, the tobacco seed then being spread out very thinly in order to hasten the drying process. The top layer—as soon as it is dry—needs to be disturbed in order that the seed underneath may be exposed to the direct rays of the sun. The following are the solutions used in testing for the presence of formaldehyde:—

Phenyl-hydrazine hydrochloride	(1 per cent.)	} both dissolved in distilled water.
Potassium ferricyanide	(5 per cent.)	

When testing for traces of formaldehyde it is necessary to take a sample of wash water, *i.e.*, water draining off the seed after the supply from pipe has been cut off. When sufficient wash water has been collected it is well shaken and 10 c.c. of it measured off into a test tube. To this is added 2 c.c. phenyl-hydrazine hydrochloride (1 per cent.), followed by 1 c.c. potassium ferricyanide (5 per cent.), which in turn is followed by 5 c.c. strong hydrochloric acid. The test tube is then shaken, and if the contents show a red or pinkish coloration it denotes the presence of formaldehyde and the seed requires further washing. When the pinkish coloration has disappeared from subsequent tests the seed will be free from all traces of formaldehyde. The above test, known as "Schryver's Test," is a very delicate one; formaldehyde one part in one million being detected.

In fifty germination tests of treated seed the average time taken for complete germination was 29 days, the shortest time being 11 days, and the longest 62 days. The average percentage of germination over the whole of these tests worked out at 74.22 per cent. In a test to determine the effects of formaldehyde treatment on tobacco seed the following were the results obtained:—

Grade of seed.	Condition.	Time elapsed between treatment and germination test.	Germination.	
			Percentage of germination.	No. of days taken for complete germination.
Heavy seed ...	Treated ...	17 days	100	30 days
do. ...	Untreated ...	...	94	9 days
Light seed A*	Treated ...	17 days	77	46 days
do.*	Untreated ...	...	94	17 days
Light seed B†	Treated ...	17 days	28	46 days
do.†	Untreated ...	...	52	46 days
Heavy seed ...	Treated ; not washed after treatment	17 days	30	49 days
do. ...	Treated ...	90 days	54	35 days

* The grade of seed blown over by the ordinary draught being passed through seed separator.

† The grade of seed blown over by a very slight draught being passed through seed separator.

In the above it will be seen that the heavy seed (treated) was delayed 21 days and gave 6 per cent. more germination than the heavy seed (untreated). Light seed A (treated) was 29 days later than light seed A (untreated) and showed 17 per cent. less germination. Light seed B (treated) germinated in the same number of days as light seed B (untreated), but showed 24 per cent. less germination. The difference in germination between heavy seed tested seventeen days after treatment and that tested ninety days after treatment is shown to be 46 per cent. in favour of the former. Therefore, to get the best results, tobacco seed should not be sown after three months or more have elapsed since treatment.

The differences in the percentage of germination and the time for complete germination between the several grades of tobacco seed are shown in the following table:—

Difference between	Treated.			Untreated.		
	Percent- age.	Time for germina- tion.	In favour of	Percent- age.	Time for germina- tion.	In favour of
Heavy seed and light seed A	23	16 days	Heavy seed	No differ- ence	8 days	Heavy seed
Heavy seed and light seed B	72	16 days	Heavy seed	42	37 days	Heavy seed
Light seed A and light seed B	49	No differ- ence	Light seed A	42	29 days	Light seed A
Heavy seed washed and heavy seed unwashed	70	19 days	Washed seed	...	...	...

The heavier grade of seed—whether treated or untreated—always gave the greater percentage of germination, besides germinating in less time than the lighter grade, the smallest difference in percentage of germination being between heavy seed and light seed A (untreated), and the greatest difference between heavy seed washed and heavy seed unwashed. The smallest difference in time for complete germination was shown between light seed A and light seed B (treated), and the greatest difference between heavy seed and light seed B (untreated).

The above table shows that the poorer the quality of the tobacco seed the less the germination which took place after treatment. This serves to show that most light or immature seed is killed by the treatment with formaldehyde solution. This is a good point when it is considered that light or immature seed seldom makes a good plant in the field and usually produces inferior leaf. Seed which has been graded in a tobacco seed separator gives better results after treatment than ungraded seed. Tobacco seed which has a lot of dust and trash mixed with it takes more water and time to wash thoroughly. The big difference in germination between washed and unwashed seed shows how important it is to thoroughly remove all traces of the formaldehyde solution from the tobacco seed after treatment.

While the heavy seed (treated) took longer to germinate than the heavy seed (untreated), the percentage of germination was higher in the former, proving that although treatment delays germination it does not immediately impair the power of germination in mature tobacco seed.

SUMMARY.

1. Use only fresh mature seed which has been graded in a tobacco seed separator.
2. Once seed has been treated do not delay the date of sowing too long.
3. Treated seed should not be saved over from one sowing season to the next.
4. To have tobacco plants ready for transplanting at the usual time, treated seed should be sown about twenty days earlier than the date on which untreated seed is generally sown.

The Dual-Purpose Animal in Southern Rhodesia.

In penning these few notes dealing with the many advantages to be derived by the average farmer in Rhodesia from the use of the dual-purpose animal, I wish at once to state that no disparagement of any other breed is aimed at. There is use in Rhodesia, as in most other countries, for all breeds, and the more we have of them the better for the country and all concerned.

Breeds of cattle are usually classed as beef, milk, or dual-purpose, and it is to this latter type that I wish to draw attention. General farming to be successful demands the keeping of live stock, both for the profit they bring as well as to maintain the fertility of farms.

Choice of breed usually depends on whether cattle are kept for ranching purposes (*i.e.*, beef) or dairying, (*i.e.*, milk and butter), or whether they are kept, as in most other countries, as a part of the general farming scheme. Of course, class of land, proximity to towns and markets, value of such lands and other factors have to be considered, but speaking generally, the breed chosen usually depends on whether the nature of farming carried on is production of beef, or production of milk, cream or butter. For both of these purposes we have the pure bred beef animal and the high producing cow. For both of these purposes one has choice of several different breeds, choice of which will generally depend on class of grazing and feeding.

But in Southern Rhodesia there is a large and ever-increasing number of farmers who depend for their living on general farming, and to this man the merits of the dual-purpose animal should appeal. By dual-purpose animal I mean an animal well fleshed that will give from 500 to 1,000 gallons of milk containing good butter fat percentage in her lactation period, and which will, moreover, breed steers equal to the pure beef breeds, as well as give a good carcass of beef when her producing days are over.

Great Britain has accepted this animal on most of her farms as the one most suited to general farming practice, and I feel sure it is a breed which will prove admirably adapted to this country. The breeds usually classed as dual-purpose are the dairy or dual-purpose Shorthorn, Lincoln Red Shorthorn, Red Poll and South Devon. Numerous herds of these cattle are to be found on most farms in Great Britain.

While Southern Rhodesia has been fortunate in some respects in having native cattle suitable for the foundation of ranching herds, it is a moot question whether the farmer in this country would not

have been in a better position if he had been compelled to begin with improved stock.

The cry throughout South Africa to-day is for better and ever better stock, and I maintain that the ordinary farmer, by keeping an animal which will give him a good yield of milk, cream or butter, plus a good carcase of beef, plus a steer fit for export, will attain this object and do more for himself and the country generally than by breeding the class of cattle we have in the country to-day. One has read pages and pages dealing with feeding for beef, feeding for milk, balanced rations, etc., etc., but very little about the class of animal which will give best results from such feeding. I suggest the dual-purpose animal on examination will prove its merits as an animal eminently suitable for this country, and I trust the above notes will cause discussion and so get farmers interested in a matter vitally important to themselves and the country generally.

STOCK BREEDER.

The Baboon Trap.

A "BOON" TO FARMERS.

By H. C. K. FENN, Acting Statistician.

The frequency with which one hears the remark, "maize destroyed by baboons," leads one to wonder whether farmers in Rhodesia are aware of the existence of a baboon trap invented and patented by a farmer named Bowker, residing in the Cradock district, Cape Province. The device appears to be constructed chiefly of wood and is of the automatic type. It is claimed that it is capable of catching as many as from eight to ten baboons at a time. A description of this trap with brief instructions appeared in the "Farmers' Supplement" to the *Sunday Times* of 5th June, 1921. Unfortunately the illustration is too indistinct to give a clear idea of the manner of

construction. It is stated to have proved so effective in the district mentioned that several farms which had been infested for years are now entirely clear of baboons. On one farm in particular over five hundred were destroyed by this means in one year.

Scores of farmers in Rhodesia are compelled, from the time the maize cobs are well formed, to keep a number of boys to do nothing else from daybreak to dark but guard against the invasion of the lands by baboons, which are almost more destructive to crops than wild pigs. The maintenance of this guard year after year is an expensive business.

The use of poison as a remedy, apart from the danger of destroying valuable sporting dogs and other harmless animals, has not proved successful in practice. The baboon is much too cunning and is seldom caught napping. A farmer once stated that he had been successful in clearing his neighbourhood of baboons by scattering their haunts with detonators hidden in lumps of mealie porridge. The idea was, no doubt, brilliant, but the story savours of De Rougemont.

The baboon or chacma (*papio porcarius*), as distinct from the mandril, a species frequenting the west coast of Africa, is mainly herbivorous and subsists on the roots of various plants common in hilly and rocky parts of Central and Southern Africa, besides numerous insects, chief of which are scorpions, centipedes and termites, found underneath stones and in dry wood. The question arises, however, whether the country, if freed from the ravages of baboons, would be any better off in other respects. It is a well known fact that baboons daily feed on millions of insects already mentioned. There is the possibility to be considered of these, if unchecked by baboons, multiplying to such an extent as to be a menace to mankind. The common fowl and certain wild birds of the bustard type, viz., pouw, koraan and plover, also the wild turkey and the secretary bird, live almost entirely on these and other insects, but in a much smaller degree than do baboons.

Some men go so far as to say that the baboon is capable of being trained and thereby becoming useful on the farm. Incidentally the writer well remembers a transport rider in the Cape Colony using a large baboon as a leader to his oxen. He would climb on to the yoke while crossing a river, and sometimes got a ducking when the oxen lowered their heads to drink. The owner said he found him to be quite as useful as a raw native. Some time afterwards, however, this baboon unfortunately got his tail jammed in the brake-block, and he never could be induced to go near a wagon again.

Cattle Squeezer.

We illustrate here a very compact and useful type of cattle squeezer which has been designed by Mr. J. R. Stewart, of Shangani.

The essential parts consist of two movable sides, suitably hinged and connected by bell crank levers, so that the whole movement is operated by a single handle.

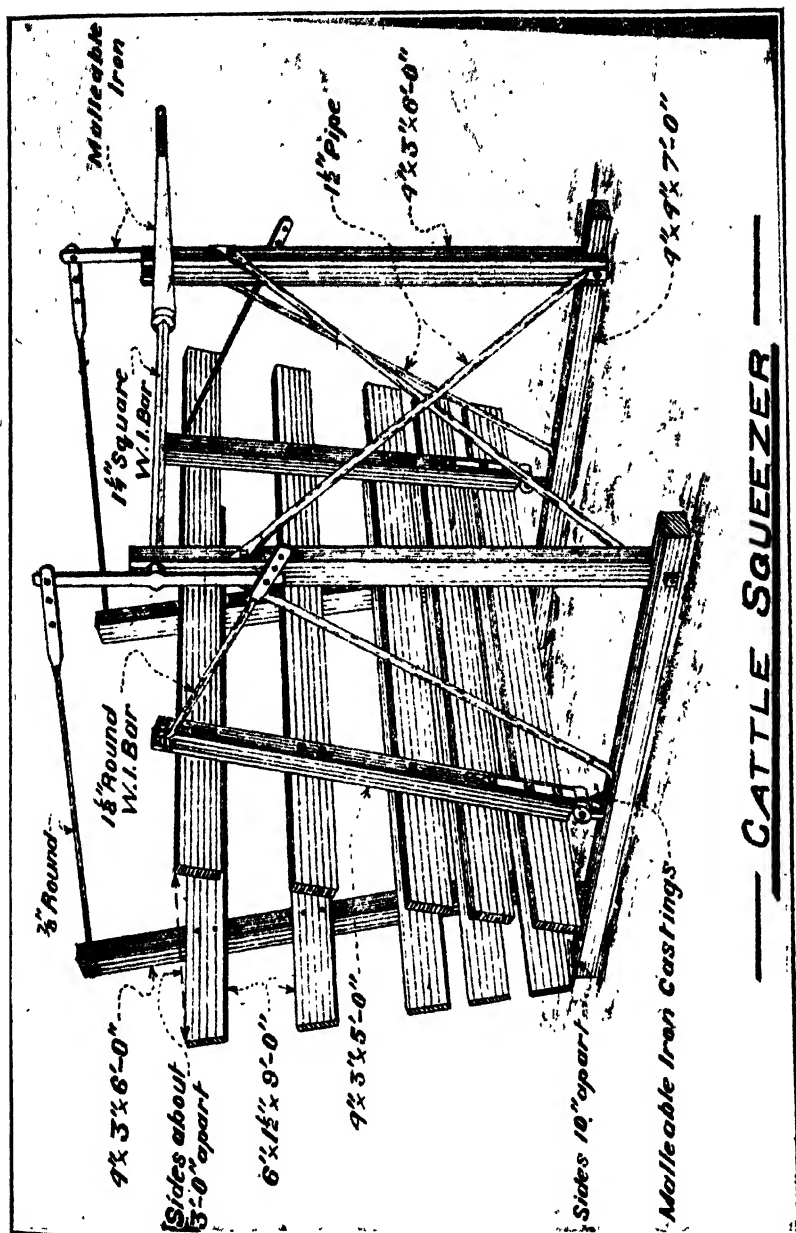
The woodwork is all of well seasoned native hardwood timber; and the fittings of suitable malleable cast or wrought iron.

The type shown here is mounted on ground cills and is entirely portable, so that it can be moved to any part of the ranch, but where it is to be fixed in one place, these cills can be dispensed with and the lower hinges secured to eye bolts fixed in a bed of concrete. The various parts have been carefully proportioned in order that sufficient pressure can be exerted to hold the largest beast, yet insufficient to do actual harm to the animal.

Mr. Stewart has had this squeezer in operation for some time past, and has found same to give most excellent results in practice; in fact, recently he passed 460 beasts through for inoculation in less than five hours without a single one being missed or hurt in any way.

Although patent rights have been secured, we understand there is no objection to individual farmers or ranchers making one for themselves, and in such cases Mr. Stewart is prepared to supply the whole of the ironwork and fittings for £12, or the complete squeezer for £20 free on rail Shangani.

No doubt many farmers will be interested in this very useful and simple type of squeezer, and those desiring further particulars can communicate direct with Mr. J. R. Stewart, P.O. Shangani.



Irrigation Notes.

SCHEMES IN HAND AND PROJECTED.

The long continued drought of the present season and the prospect of a very dry winter season are of very great concern to farmers, and many are pushing on with irrigation schemes and the development of water supplies which have been in abeyance. Amongst the various schemes being taken in hand might be mentioned the following:--

The Riversdale Estate Syndicate, which has large properties in the Mazoe district, is proceeding with the erection of a storage dam in the Wataikai River. This dam, which is the first of a series which will probably be constructed in this river, will have a height of 15 ft. above stream bed, and is to be constructed of concrete with masonry face work. The conservation afforded will augment the normal flow of the stream, which is used for the irrigation of about 80 acres of established orange trees.

Another scheme recently completed by the same company comprises a small stone and wire net weir in the Umrodsi River and a canal about a mile in length. The area to be irrigated is about 20 acres and will be largely utilised for the growing of fodder crops for pedigree and other stock.

Mr. A. R. Morkel, of the farm Ceres, near Shamva, is contemplating commencing work on his scheme in the Umwindsi River. This is a scheme of some magnitude which has been under consideration for some years, and consists of taking out a canal about eight miles in length from the Umwindsi River and diverting the water across the watershed for the irrigation of several hundred acres of fertile lands on Ceres. A good deal of work will be involved in carrying the scheme to maturity, but in view of the vast possibilities of the area for closer settlement it is considered to be well justified.

The farm Westacre Creek, forming part of the Rhodes Matopos Estate and formerly occupied by the late Mr. Hull, has recently been sub-divided into five small farms, each one embracing a portion of the irrigable land below the Matopos Dam. These farms, in addition to carrying stock, are well suited for dairying, poultry rearing and the production of nearly all kinds of winter irrigated crops, for which there should be a ready market in Matabeleland.

It has perhaps not yet been fully realised what extensive irrigation

possibilities exist in the Victoria district, and we are therefore pleased to note that Mr. H. Harper, of the farm Glenlivet, is about to construct a scheme on the Umtilikwe River for the irrigation of 100 or more acres of good red land on his farm. Mr. Harper, who already has a very fine orchard of mixed fruit trees under irrigation from a small stream near the homestead, intends under the new scheme specialising in citrus, wheat and all kinds of feed crops for cattle.

The Irrigation Branch of the Department of Agriculture has in hand numerous applications for surveys of other projected schemes and also for advice in connection with well-sinking and other developments. It is also recommencing in the native reserves boring operations, which were successfully carried on last season.

The Second Southern Rhodesia Egg-Laying Test.

REPORT ON THE TWELFTH PERIOD.

(2nd February to 2nd March, 1922).

Eighty birds were laying during the four weeks, and produced 890 eggs, an average per laying bird of 11.12 eggs, or for the 97 now on the test 9.17 eggs per bird. The total weight of eggs for the four weeks was 119 lbs. 11 4-16 oz. (105 lbs. 3 15-16 oz. of eggs 2 oz. and over, and 14 lbs. 7 5-16 oz. of eggs under 2 oz.).

The maximum number of eggs laid on one day was 43 on the 4th February, the minimum 22 on the 22nd of February. The average number per day was 32.

Pen 2 laid 70 eggs during the four weeks. Of the trap-nest birds the following laid :—

- 21 eggs—No. 59, pen 12.
- 20 eggs—No. 36, pen 8.
- 20 eggs—No. 41, pen 9.
- 20 eggs—No. 81, pen 17.
- 19 eggs—No. 5, pen 1.
- 19 eggs—No. 22, pen 5.

Nine birds have been broody during the four weeks and 82 birds moulting. Most of the birds are not laying well.

One bird in pen 20 died during the month of peritonitis following ruptured ovum. It was not replaced, seeing the test was almost concluded.

As will be noted, pen 9, which has been leading for some time, has been beaten on the post. One bird in this pen went into moult in January, and the work subsequently has been done by the other four. Pen 13 (which, by the way, was the number of the pen which won last test) has put up a good fight, gradually working its way up to first place, and well deserves to win. Its owner is to be congratulated on his success.

As will be seen, the results of this, the second Rhodesia test, are as follows:—

Heavy Breed Section.—

- (1) Mr. C. L. Brown.
- (2) Mrs. Brokensha.
- (3) Mr. H. Tatham.

Light Breed Section.—

- (1) Weymouth Poultry Farm.
- (2) Mr. C. L. Brown.
- (3) Mr. T. W. Brokensha.

A further report on this test will be published shortly.

The weather during the four weeks has been very hot and dry

THE SECOND ANNUAL SOUTHERN RHODESIAN EGG-LAYING TEST.
FIVE BIRDS IN EACH PEN. TWELFTH PERIOD (48 WEEKS).
1ST APRIL, 1921, TO 2ND MARCH, 1922.
HEAVY BREED SECTION.

Pen No.	Position.	Owner.	Residence.	Breed.	Results from 1st April to 2nd March, inclusive.		
					Total No. of eggs.	Total weight of eggs.	
					2 ozs. and over.	2 ozs. and over.	Under 2 ozs.
1	6	R. Coulthard	Salisbury	White Wyandottes	522	66 lbs. 2 3-16 ozs.	46 lbs. 3 8-16 ozs.
2	2	Mrs. Brokensha	Umtali	do.	696	96 lbs. 3 ozs.	2 lbs. 3 12-16 ozs.
3	7	Mrs. Pocock	Ardennie	Bd. Plymouth Rocks	384	54 lbs. 5 11-16 ozs.	3 lbs. 4 6-16 ozs.
4	1	C. L. Brown	Salisbury	Rhode Island Reds	835	115 lbs. 4 7-16 ozs.	3 lbs. 6 8-15 ozs.
5	3	H. Tatham	Penhalonga	White Wyandottes	687	91 lbs. 2 8-16 ozs.	10 lbs. 6 9-16 ozs.
6	5	A. G. Walker	Salisbury	do.	628	80 lbs. 15 5-16 ozs.	9 lbs. 4 5-16 ozs.
7	4	A. T. Wagstaff	Pretoria	Black Orpingtons...	633	82 lbs. 5 5-16 ozs.	12 lbs. 12 9-16 ozs.
Totals					4,385	586 lbs. 6 7-16 ozs.	87 lbs. 9 9-16 ozs.

LIGHT BREED SECTION.

8	12	E. O. B. Mee	Bulawayo	White Leghorns	686	88 lbs. 10 12-16 ozs.	39 lbs. 13 11-16 ozs.
9	2	C. L. Brown	Salisbury	do.	967	126 lbs. 0 10-16 oz.	7 lbs. 11 15-16 ozs.
10	11	Mrs. Redrup	Bulawayo	Black Leghorns	707	93 lbs. 4 2-16 ozs.	11 lb. 4 1 5-16 ozs.
11	3	T. W. Brokensha	Umtali	White Leghorns	918	120 lbs. 15 1-16 ozs.	22 lbs. 9 8-16 ozs.
12	4	B. S. Edgecumbe	do.	do.	921	119 lbs. 15 9-16 ozs.	11 lbs. 10 2-16 ozs.
13	1	Weymouth Py. Fm.	Bulawayo	Anconas	974	126 lbs. 8 5-16 ozs.	17 lbs. 3 10-16 ozs.
14	9	Yorkshire Py. Farm	do.	do.	684	94 lbs. 1 6-16 ozs.	15 lbs. 9 7-16 ozs.
15	8	Miss Greig	do.	White Leghorns	772	99 lbs. 15 10-16 ozs.	15 lbs. 14 13-16 ozs.
16	5	E. C. Holmes	Bindura	do.	920	119 lbs. 0 11-16 oz.	21 lbs. 13 12-16 ozs.
17	13	Avondale Py. Farm	Avondale	do.	434	53 lbs. 12 3-16 ozs.	54 lbs. 12 7-16 ozs.
18	10	Mrs. Redrup	Bulawayo	Anconas	717	93 lbs. 5 6-16 ozs.	8 lbs. 1 14-16 ozs.
19	7	Mrs. Mulligan	Lobatsi	White Leghorns	752	106 lbs. 14 2-16 ozs.	8 lbs. 8 1-16 ozs.
20	6	Mrs. Hunter	P.B. Glendale	do.	795	111 lbs. 0 5-16 oz.	4 lbs. 3 14-16 ozs.
Totals					10,247	1,353 lbs. 8 2-16 ozs.	239 lbs. 2 7-16 ozs.
Grand totals of both sections					14,632	1,939 lbs. 14 9-16 ozs.	326 lbs. 12 ozs.

Total number of eggs for 48 weeks (12 periods), 17,375; total weight, 2,266 lbs. 10 9-16 ozs.
There are 97 birds now on the Test. Positions are calculated on total weight of 2 oz. and over eggs.

Third Annual Rhodesia Laying Test.

This test commences on 1st April. The following have entered pens :—

HEAVY BREED SECTION.

Pen No.	Owner.	Residence.	Breed.
1	Mrs. Watson ...	Glendale ...	Rhode Island Reds
2	Mrs. Bernard ...	Headlands ...	do
3	J. B. Stokes ...	Salisbury ...	White Wyandettes
4	Mrs. Cheeseman ...	Umvuma ...	Rhode Island Reds
5	Mrs. Colborne ...	Banket ...	Black Orpingtons
6	Mrs. Skillen ...	Bulawayo ...	Rhode Island Reds

LIGHT BREED SECTION.

7	Mrs. Hatton ...	Umvuma ...	White Leghorns
8	Mrs. Graham ...	Avondale ...	do
9	Mrs. Hunter ...	Glendale ...	do
10	Mrs. Colborne ...	Banket ...	do
11	Mrs. Watson ...	Glendale ...	do
12	F. Knighton ...	Bulawayo ...	do
13	J. Cook ...	Capetown ...	do
14	Weymouth Poultry Farm ...	Bulawayo ...	do
15	Mrs. Michell ...	Salisbury ...	do
16	E. Holmes ...	Bindura ...	do
17	Miss Greig ...	Bulawayo ...	do
18	C. E. Walton ...	Salisbury ...	do
19	Mrs. Russell ...	Que Que ...	do
20	Golden Grove Poultry Farm ...	Rondebosch, C.P.	do

The class of birds is good, and shows an improvement generally on previous tests.

There were more entries than pens available, and a ballot had to be taken; subsequently two pens fell out and others have taken their places.

The birds are settling down well.

Further particulars and details of the last test will be published when these are compiled.

Southern Rhodesia Veterinary Report.

December, 1921.

AFRICAN COAST FEVER.

No cases occurred during the month.

QUARTER-EVIL.

The following mortality in cattle was reported:—Victoria 15, Nyamandhlovu 8, Umzingwane 17, Plumtree 23, Matobo 12, Gwelo 17, Selukwe 14, Melsetter 4, Gwanda 2, and a few deaths in the Makoni and Inyanga districts.

CONTAGIOUS ABORTION OF CATTLE.

Centres of infection, previously unknown, were found in the Gwelo, Hartley, Marandellas and Charter districts. During the month 5,585 doses of vaccine were issued from the veterinary laboratory.

SCREW WORM (MYIASIS) OF CATTLE.

Cases reported from the Plumtree, Gwanda, Salisbury and Mazoe districts. This very troublesome affection does not seem to be so prevalent as during last season.

EPHEMERAL FEVER (THREE DAYS' SICKNESS OF CATTLE).

Prevalent in Nyamandhlovu district.

SWEATING SICKNESS OF CALVES.

Cases reported from the Bulawayo and Umzingwane districts. As a rule this affection is seen in young calves only, but in Victoria district animals twelve to fifteen months old were affected.

WIREWORM IN CATTLE.

A number of deaths reported from this condition, which is much more prevalent than is generally supposed. A good deal of the mortality in cattle which occurs every year towards the end of the winter season is really due to wireworm.

HORSE-SICKNESS.

The following mortality was reported:—Victoria 2 horses, Charter 3 horses.

IMPORTATIONS.

From the Union of South Africa:—Bulls 59, cows and heifers 3, horses 42, mules 28, donkeys 20, pigs 25, goats 180, sheep 2,340.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 107, breeding cattle 92, pigs 55. To Congo:—Pigs 20; sheep 40, cows 60, calves 32, donkeys 16. To Northern Rhodesia:—Pigs 4, sheep 126. To Portuguese East Africa:—Slaughter oxen 132, horses 2, donkeys 4, goats 35.

January, 1922.

AFRICAN COAST FEVER.

No cases occurred during the month.

ANTHRAX.

One case occurred in a herd of native cattle in the Mtoko district. All animals in contact were inoculated.

QUARTER-EVIL.

The following mortality in cattle was reported:—Marandellas 12, Mazoe 1, Salisbury 2, Melsetter 6, Inyanga 20, Umtali 8, Makoni 10, Nyamandhlovu 4, Matobo 23, Bulawayo 10, Umzingwane 2, Bulalima-Mangwe 29, Belingwe 4, Gwanda 4, Victoria 23, Gwelo 16, Charter 7, Hartley 1.

CONTAGIOUS ABORTION.

Three fresh outbreaks were reported.

MYIASIS (SCREW WORM) OF CATTLE.

Generally this affection appears to be decreasing. Cases reported from the Umtali, Charter, Salisbury, Matobo, Nyamandhlovu, Gwanda and Bulalima-Mangwe districts.

SWEATING SICKNESS OF CALVES.

A few cases reported from the Salisbury, Belingwe, Bubi and Matobo districts.

HORSE-SICKNESS.

Twenty deaths reported, of which 11 occurred in Gwanda district.

POISONING OF CATTLE.

Stock owners are advised that nitrate of soda is very poisonous. In one instance 13 head succumbed through licking this substance. A number of deaths from arsenical poisoning reported from several districts.

IMPORTATIONS.

From the Union of South Africa:—Bulls 1, cows and heifers 23, horses 5, mules 9, donkeys 27, sheep 2,860, goats 612.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 124, donkeys 12, horses 2, pigs 156. To Congo:—Pigs 65, sheep 65. To Northern Rhodesia:—Horses 3, pigs 41, sheep 90, goats 25. To Portuguese East Africa:—Slaughter oxen 84.

February, 1922.

AFRICAN COAST FEVER.

No cases occurred during the month.

QUARTER-EVIL.

The following mortality in cattle was reported:—Melsetter 5, Bubi 30, Nyamandhlovu 7, Matobo 22, Gwanda 12, Gwelo 5, Victoria 16, Salisbury 1, Marandellas 4, Macheke 4.

CONTAGIOUS ABORTION OF CATTLE.

Two fresh outbreaks reported.

MYIASIS (SCREW WORM) OF CATTLE.

Cases reported from Mazoe, Umtali, Charter, Gwanda, Nyamandhlovu and Bulalima-Mangwe. The District Veterinary Surgeon, Gwelo, reports that most satisfactory results have followed treatment with dry calcium carbide.

SWEATING SICKNESS OF CALVES.

There was a considerable increase in the number of cases of this disease during the month. Its existence was reported from the following districts:—Mazoe, Lomagundi, Salisbury, Marandellas, Hartley, Belingwe, Insiza, Gwanda. Bulawayo, Bubi, Umzingwane and Nyamandhlovu.

HORSE-SICKNESS.

Twenty-seven deaths reported.

IMPORTATIONS.

From the United Kingdom:—Bulls 5, heifers 6. From Union of South Africa:—Bulls 20, heifers 16, horses 15, donkeys 10, sheep 1,854, goats 605.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 242, breeding stock *via* Liebig's Drift 420, pigs 154. To Congo:—Pigs 61, cattle 15, donkeys 16, sheep 40, goats 65. To Northern Rhodesia:—Pigs 6, sheep 60. To Portuguese East Africa:—Slaughter cattle 117, sheep 50.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

Agricultural Outlook.

The anxiety which was being felt when our last issue went to press at the exceptional spell of dry weather has not been alleviated by the conditions since that date. So far as Mashonaland is concerned, general and substantial rains fell at the beginning of February over the greater part of the province, and considerably improved the outlook, but another lengthy period of drought has supervened, and the position at date is far from promising. Matabeleland as a whole is worse off than Mashonaland, and unless considerably more rain falls the water supplies in several districts will not be sufficient for man or beast during the winter season, while grazing will be very sparse. There is, however, plenty of time before the wet season can be considered as having terminated, and we can only hope that the drought will speedily break. Farmers in both provinces would be well advised to continue the cutting of veld grass, and to fill silo pits with crops such as maize, sunflowers, velvet beans, etc., which have failed to produce grain. Where the vlei soils are retaining their moisture, these should now be cross ploughed (it being presumed that the first ploughing has already been done) and the land put into tilth for the planting of wheat about the middle of May. Seed stored for sowing should be gone over for weevil infestation, which often affects germination. It is to be feared that unless late and plentiful rains occur the area under winter cereals will be curtailed considerably this year.

The position in regard to the maize and tobacco crops has not altered materially since our last notes were written. Both crops have, despite the adverse conditions, done exceptionally well in places, but for the most part reduced yields can only be expected. There should, however, be sufficient maize reaped for the requirements of the country.

Great vigilance will have to be exercised to preserve the veld grass. Already extensive grass fires have occurred in the drier parts of the country and considerable damage has been done. The burning of fire guards should receive special attention, whilst a system of supervision by native patrols, such as we have referred to frequently in this journal, is well worthy of consideration. The matter is urgent, and early action is necessary.

Cattle are reported to be in good condition and generally free from disease. The outlook for the winter season, unless the drought breaks, is disquieting, for already a shortage of water supplies is reported from Matabeleland. The price of stock is low, and likely to remain so, until an outlet for our accumulating surplus is found. The decision to re-open the Odzi Canning Factory is pleasing news, but this does not provide a solution of the difficulty, which will only be found by export. New markets are necessary, for the Rand does not offer much promise. The shrinkage in our exports of slaughter stock to the Union is revealed by the trade returns for 1921, which show that only 8,965 head, valued at £77,119, were sent south, against 24,142, valued at £235,394, in 1920. Hides and skins, which figured prominently in our list of exports in 1920, when they represented an amount of £189,869, fell last year to £32,211. A brighter picture is shown by the figures of butter exported, which increased from 204,678 lbs., valued at £29,262, in 1920, to 421,815 lbs., valued at £47,165, in 1921. Tobacco also shows an appreciable increase with a value of £196,702 exported in 1921, as against £152,495 in 1920.

RHODESIAN MILK RECORDS.—RETURN FOR FIRST 28 DAYS.

Name or number of cow.	Breed	Commenced record.	Milk in lbs.	Per cent. butter fat	Butter fat in lbs.	Total milk to date in lbs.	Total butter fat to date in lbs.	Name and address of owner.
Brakfontein Aggie ..	Fries-land	1/2/22	1,014.25	...	..	1,014.25	...	Reiniker & Rettie, Salisbury.
No. 32* ..	do	1/1/22	490	..	..	490	...	Col. Sir R. Grey, Riversdale Estate.
No. 30* ..	do	do	581	..	..	581	...	do
No. 34* ..	do	do	483	..	..	483	...	do
No. 29* ..	do	do	399	..	..	399	...	do
No. 17* ..	do	do	511	..	..	511	...	do
No. 12* ..	do	do	757	..	..	757	...	do
No. 10* ..	do	do	469	..	..	469	...	do
No. 7* ..	do	do	476	..	..	476	...	do
No. 4* ..	do	do	420	..	..	420	...	do
No. 38* ..	do	do	434	..	..	434	...	do
Fanny ..	Short-horn	4/9/21	728	..	..	728	...	J. H. Parker, Vailima Dairy, Byo.
Bessie ..	Fries-land	30/8/21	735	..	..	735	...	do
Sally ..	Short-horn	11/10/21	745	..	..	745	...	do
Dina ..	Fries-land	14/12/21	665	..	..	665	...	do
Fanny ..	Short-horn	26/12/21	836.5	..	..	836.5	...	do
Queenie ..	..	26/1/21	742	..	..	742	...	do
Gippy ..	Short-horn	22/8/21	742	..	..	742	...	do
Kitt ..	Fries-land	..	686	..	..	686	...	do
Nanny ..	do	..	683	..	..	683	...	do
Lady (a) ..	do	3/9/21	700	3.4	23.8	700	23.8	J. S. Struthers, Palm Tree, Sinona.
Corral (b) ..	do	4/2/22	301	4.0	12.0	301	12.0	do
Snowflake ..	do	19/2/22	234	3.5	8.19	234	8.19	do
Spottie* ..	do	22/1/22	149	..	..	149	...	do
Henrietta* ..	Short-horn	22/7/21	276.5	..	..	276.5	...	R. C. MacLagan, Chitona, Rusape.
Agnes* ..	do	2/8/21	199.5	..	..	199.5	...	do
Cowslip* ..	do	9/9/21	189	..	..	189	...	do
Elaine* ..	Ayrshire	14/10/21	164.5	..	..	164.5	...	do
Roan Beauty* (c) ..	Short-horn	do	98	..	..	98	...	do
Susie ..	do	23/11/21	419.3	3.95	16.56	419.3	16.56	do
	do	28/12/21	..	..	..	..	..	C. G. T. Cooper, Chambrey, Essex-

* These cows are suckling their calves

(a) 21 days only.

(b) 7 days only.

(c) 14 days only.

RETURN FOR THIRD 28 DAYS.

Name of cow.	Breed.	Commenced record.	Milk in lbs.	Per cent butter fat.	Butter fat in lbs.	Total milk to date in lbs.	Total butter fat to date in lbs.	Name and address of owner.
Daisy ...	Shorthorn	2/11/21	352.8	3.93	13.86	1,206.8	46.37	C. G. T. Cooper, Essexvale.
Zaza ...	do	do	352.8	4.11	14.5	928.9	37.56	do do
N'Genga ...	do	30/11/21	397.6	5.07	20.16	1,193.5	55.36	do do
Pepper ...	do	do	302.4	4.81	14.54	976.5	42.62	do do
Chunboke ...	Friesland	1/9/21	304.0	...	...	1,231	...	G. W. Davis, N'Gombe, Sinoia.
Seponika ...	do	8/10/21	437.5	...	...	1,514.5	...	do do
Gandwan ...	do	do	325	...	...	1,410	...	do do
Panami ...	do	do	693	...	...	1,851	...	do do
Quetti... ..	do	do	955.5	...	...	2,445.5	...	do do
Spotrie* ...	Shorthorn	22/7/21	296.5	...	...	509	...	R. C. MacLagan, Chitora, Rusape.
Henrietta* ...	do	2/9/21	290.5	...	...	795	...	do do
Agnes* ...	do	9/9/21	192.5	...	...	574	...	do do
Cowslip* ...	Ayrshire	14/10/21	269.5	...	...	686	...	do do
Elaine* ...	Shorthorn	do	187.5	...	...	518	...	do do
Roan Beauty* ...	do	23/11/21	185.5	...	...	497	...	do do
Fanny ...	do	4/9/21	777	...	...	2,261	...	J. H. Parker, Vailima Dairy, Byo.
Bessie ...	Friesland	30/8/21	756	...	...	2,236	...	do do
Sally ...	Shorthorn	11/10/21	777	...	...	2,278	...	do do
Gippy ...	Friesland	22/8/21	829.5	...	...	2,351.5	...	do do
Kitt ...	do	do	693	...	...	2,061.5	...	do do
Nanny ...	do	3/9/21	798	...	...	2,229.5	...	do do
Rosebud ...	do	9/10/21	588	4.8	28.2	1,952	87.6	J. S. Struthers, Palm Tree, Sinoia.
Granny ...	do	do	542	4.6	24.9	1,741	72.98	do do
Maureen ...	do	do	865	3.8	32.87	2,793	90.71	do do
Cherry Blossom ...	do	16/10/21	518	5.3	27.45	1,867	93.63	do do
Bell ...	do	20/11/21	609	3.8	23.14	3,393	117.79	do do
Rose ...	Red Poll	25/11/21	679	4.1	27.84	2,044	77.12	W. R. Waller, Bluff Hill, Salisbury.
Alice ...	do	do	808.5	4.3	34.76	2,519	104.26	do do
Papi* ...	do	18/11/21	605.5	4.1	24.82	1,809	69.22	do do

* These cows are suckling their calves.

RETURN FOR FOURTH 28 DAYS.

Panami	...	...	612.5	...	...	G. W. Davis, N'Gombe, Sinoia.
Quetti	...	8/10/21	892	...	2,463.5	do do
Daisy ...	...	2/11/21	327.6	...	1,534.4	C. G. T. Cooper, Essexvale.
Spotie*	...	22/7/21	224	5.12	16.77	R. C. MacLagan, Chitora, Rusape.
Henrietta*	...	2/9/21	336	..	733	do do
Agnes*	...	9/9/21	280	...	1,131	do do
Cowslip*	...	14/10/21	206.5	...	854	do do
Elaïne*	...	do	122.5	...	892.5	do do
Roan Beauty*	...	23/11/21	147	...	640.5	do do
Fanny	...	4/9/21	791	...	682.5	do do
Bessie...	...	30/8/21	773.5	...	3,052	J. H. Parker, Vailima Dairy, Bvo.
Sally ...	...	11/10/21	777	...	3,009.5	do do
Gippy ...	...	22/8/21	831.25	...	3,055	do do
Kitt	...	do	724.5	...	3,182.75	do do
Nanny	...	3/9/21	823½	...	2,786	do do
Rosebud	...	9/10/21	535	...	3,052	do do
Granny	...	do	489	5	26.75	J. S. Struthers, Palm Tree, Sinoia.
Maureen	...	do	875	4.5	2,230	do do
Cherry Blossom	...	16/10/21	665	4	3,668	do do
Bell ...	...	20/11/21	1,222	5.2	34.58	do do
Rose ...	...	25/11/21	602	4	128.21	do do
	...			4.3	166.67	do do
	...				2,646	W. R. Waller, Bluff Hill, Salisbury.
	...				102.96	

* These cows are suckling their calves.

Review.

"DISEASES OF ANIMALS IN SOUTH AFRICA."

It has been a very common complaint by stock owners that no book or treatise existed which dealt with the diseases of stock in South Africa. It is true that practically the whole field has been covered by articles which appeared in the agricultural journals of the various Colonies prior to Union, and since then in the Union and our own journals; also in the annual veterinary departmental reports and special reports issued as the result of extensive research work on such diseases as rinderpest, coast fever, redwater, gall-sickness, lamziekte, etc. Such reports, however, are not always accessible to the stock owner, and even those who subscribe to all the journals in which these reports appear do not always preserve them for future reference. This state of affairs has now been remedied by Mr. C. R. Edmonds, the Assistant Chief Veterinary Surgeon at Bulawayo, who has just published a book entitled "Diseases of Animals in South Africa."

The work is divided into three parts, with an introductory chapter which deals with the classification of parasites, notifiable diseases and the detection of diseases. The first part deals with diseases caused by vegetable parasites, such as strangles, pneumonia, quarter evil, anthrax, etc. The second part is divided into three sections; the first deals with diseases caused by animal parasites, the second with diseases caused by insects, and the third with diseases caused by worms. The chapters dealing with tick-transmitted diseases, trypanosomal affections and gastric and intestinal parasites will be found particularly interesting and instructive. The third part deals with diseases caused by an ultra-visible virus such as rinderpest, horse-sickness, ephemeral fever (three days' sickness), foot and mouth disease, etc.

In the chapter dealing with contagious bovine pleuro-pneumonia, it is stated that the Animals Diseases Consolidation Ordinance of 1904 imposes a special warranty by the vendor of cattle should the disease break out within twenty-one days after the purchase of cattle, and that if it spreads from such animals the vendor can be held responsible for all damage done. Further, that a warranty is implied that cattle sold have not been inoculated for lung sickness within 60 days previous to sale. These provisions were repealed by Ordinance No. 2 of 1913. Perhaps the feature of Mr. Edmonds' book which will appeal most to stock owners is the easy and fluent style and the absence of technical terms and phrases. Generally it is a most valuable work and no stock owner should be without a copy.

The publishers, Messrs. Bailliere, Tindall & Cox, London, are to be congratulated on the production of a neat and compact volume which contains 477 pages and a number of excellent illustrations.

Weather Bureau.

JANUARY AND FEBRUARY.

Pressure.—During the month of January the mean barometric pressure was below normal (0.02 in.) in southern Matabeleland, normal in central Matabeleland, below normal (0.03 in.) in northern Mashonaland, and below normal (0.02 in.) along the eastern border. High pressures were recorded at Salisbury and Bulawayo on the 2nd, 10th, 24th and 28th, the maximum high on the 2nd being 0.13 in. above normal at Bulawayo and 0.09 in. above normal at Salisbury. Low pressures were recorded at Salisbury on the 8th, 21st and 27th, and at Bulawayo on the 8th, 22nd and 27th. The minimum low at Salisbury on the 21st was 0.13 in. below normal, and at Bulawayo 0.10 in. below normal on the 22nd.

During February the mean barometric pressure was normal in Matabeleland, below normal (0.03 in.) in Mashonaland, and 0.05 in. below normal along the eastern border. High pressures were recorded at Salisbury and Bulawayo on the 6th and 15th, the maximum high on the 15th being 0.08 in. above normal at Bulawayo and 0.05 in. above normal at Salisbury. Low pressures were recorded at Salisbury and at Bulawayo on the 10th and 18th. The minimum low at Salisbury on the 10th was 0.12 in. below normal, and at Bulawayo was 0.09 in. below normal.

Temperature.—During January the mean temperature was 1.4° F. above normal at Bulawayo, and varied to 4.5° F. above normal at Salisbury. At Bulawayo the mean daily temperature was 4.7° F. above normal, and varied to 10.6° F. above normal at Salisbury. In Mashonaland the daily temperatures recorded during January were the maximum ever recorded during the period covered by the records. The mean night temperatures varied from 0.4° F. below normal at Gwelo to 1.9° F. below normal at Bulawayo.

During February the mean temperature varied from normal at Salisbury to 1.8° F. above normal at Gwelo.

The mean daily temperature varied from 0.5° F. above normal at Umtali to 3.3° F. above normal at Bulawayo.

The mean night temperatures varied from 1.7° F. above normal at Gwelo to 1.8° F. below normal at Bulawayo.

Rainfall.—At the end of December the mean seasonal rainfall was above the average over the whole country, with the exception of Zone F, where there was a slight deficiency of 0.80 in. This favourable condition was not maintained during the months of January and February. The period under review was characterised by practically a total failure of the general rains.

Such rains as have fallen were "convective" in type similar to the early rains, and were therefore patchy and local in character on any one day. This fact is reflected in the accompanying schedule, in which it will be noted that the greatest deviations from normal were experienced at those stations which, owing to their favourable topographical situation, normally receive the greatest amount of rain during these months.

The following table shows the general position in the different zones during the period:—

		Mean rainfall, Jan., 1922.	Mean rainfall, Feb., 1922.	Mean seasonal rainfall to end of Feb.	Normal rainfall to end of Feb.	De- ficiency, Jan. (approx.).	De- ficiency, Feb. (approx.).
Zone A	..	0.70	2.18	13.19	21.15	6.0	2.0
Zone B	..	0.25	1.53	9.44	18.85	6.0	3.0
Zone C	..	0.64	3.17	16.91	24.59	7.0	4.0
Zone D	.	1.49	3.47	17.35	28.11	8.0	4.0
Zone E	...	0.67	2.50	16.89	27.22	7.0	3.5
Zone F	..	2.16	4.53	25.02	43.89	10.0	8.0

The percentage deviations below normal in the different zones is as follows:—Zone B 50 per cent., Zone F 43 per cent., Zones A, D, E, 38 per cent., and Zone C 31 per cent.

As regards individual districts in these zones, Wankie has been the most favoured, having a deficiency of only 16 per cent. ($3\frac{1}{4}$ ins.) below normal. Ndanga, with a deficiency of 55 per cent. ($13\frac{1}{4}$ ins.), shows the greatest deviation from normal, while Umzingwane and Makoni are each 50 per cent. below normal, the deficiency being 10 and 14 ins. respectively.

During January the only districts in which the mean rainfall exceeded an inch were the following:—Melsetter (3.10), Darwin (2.50), Wankie (2.10), Mrewa (2.08), Mtoko (1.89), Lomagundi (1.70), Mazoe (1.65). In the great majority of cases the rainfall during January was the minimum ever recorded at individual stations during this month. During the period 11th to 22nd January no rain was recorded at any station in the Territory; on the 23rd rain was recorded at western and northern stations, and became fairly general as scattered showers from the 28th.

During February the position improved somewhat, and rain was general from the 1st to 10th, light scattered showers 11th to 21st, and dry period again from 21st to 28th, except along the eastern border, where good rains were experienced. During this month the only dis-

trict with a mean fall above the average was Wankie (approximately 2 ins. above normal).

In Zone A the shortage during February was most pronounced in the western portion of Gwelo district, with 88 per cent. (4.80 ins.) below normal, and Bubi district 80 per cent. (3.80 ins.) below normal varying to 55 per cent. below normal (exception of Wankie district) in other portions of the zone.

In Zone B the most favoured district in February was Bulalima-Mangwe, with a shortage of 50 per cent. (2.10 ins.) below normal, and varying in other portions of the zone to a maximum of 86 per cent. (3.90 ins.) below normal in Matobo district.

In Zone C the most favoured district in February was Lomagundi, with a shortage of 32 per cent. (2.40 ins.) below normal, and varying in other portions of the zone to a maximum of 59 per cent. (4.30 ins.) below normal in Hartley district.

In Zone D the most favoured district in February was Mazoe, with a shortage of 17 per cent. (1.30 ins.) below normal, and varying in other portions of the zone to a maximum of 90 per cent. (6.30 ins.) below normal in northern portion of Makoni district.

In Zone E the most favoured district in February was the eastern portion of Charter district, with a shortage of 30 per cent. (2.00 ins.) below normal, and varying in other portions of the zone to a maximum of 81 per cent. (4.50 ins.) below normal in the south-western portion of Gwelo and Selukwe districts.

In Zone F the shortage during February amounted to 65 per cent. (3.00 ins.) below normal.

Up to the time of writing (20th March) the position has not been improved, as although there have been scattered showers generally throughout the country, the total fall during March is still below the normal. The following table shows the position in the main districts in the Territory, the fall during March to date being estimated from a few stations which send in daily returns:—

District.	Mean rainfall, Jan.	Mean rainfall, Feb.	Rainfall to 20th Mar. (1 to 3 stations each district).	Total, 1st Jan. to 20th Mar.	Normal, 1st Jan. to 20th Mar.
Matabeleland.—					
Bulalima	0.44	1.92	0.64	3.00	13.47
Bulawayo	0.57	1.25	0.07	1.89	13.16
Bubi	0.61	0.94	0.65	2.20	13.97
Belingwe	0.14	0.82	0.58	1.54	13.59
Gwanda	0.23	1.18	0.65	2.06	11.16
Gwelo	0.51	1.09	0.71	2.31	14.80
Insiza	0.24	0.87	0.25	1.36	13.37
Umzingwane	0.04	0.75	0.87	1.66	14.83
Wankie	2.10	7.35	0.59	10.04	13.58

District.	Mean rainfall, Jan.	Mean rainfall, Feb.	Rainfall to 20th Mar. (1 to 3 stations each district).	Total, 1st Jan. to 20th Mar.	Normal, 1st Jan. to 20th Mar.
Mashonaland.—					
Charter	0.46	3.09	0.18	3.73	17.21
Darwin	2.50	4.02	—	6.52	19.34
Gutu	0.58	1.59	0.05	2.22	18.39
Hartley	0.68	2.97	0.71	4.36	19.59
Inyanga	0.15	1.81	0.88	2.84	25.82
Lomagundi	1.70	5.19	0.05	6.94	21.30
Makoni	0.56	1.52	0.02	2.10	21.96
Marandellas	0.45	2.14	0.20	2.79	21.47
Mazoe	1.65	6.54	0.99	9.18	22.42
Melsetter	2.40	4.56	0.49	7.45	47.31
Mrewa	2.08	2.69	0.74	5.51	23.05
Salisbury	0.72	4.96	0.78	6.46	20.58
Umtali	0.89	4.18	0.26	5.33	22.25
Victoria	0.32	2.57	0.15	3.04	17.26

RAINFALL.

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Jan.	Feb.		
ZONE A.:				
Bubi—				
Imbesu Kraal	86	80	17.03	20.70
Inyati	62	1.52	12.88	20.26
Bulalima—				
Kalaka	68	2.27	10.74	19.60
Riverbank	81	1.62	10.22	20.61
Bulawayo—				
Fairview Farm	33	...	...	19.32
Keendale	08	73	13.79	18.10
Lower Rangemore	56	1.30	12.48	20.51
Observatory	1.43	95	14.14	19.56
Paddy's Valley	26	2.02	16.43	19.40
Gwelo—				
Dawn	63	24	12.53	20.40
Riverdale ... ..	...	...	...	...
Somerset Estate	51	1.02	13.46	20.96
Wankie—				
Waterford	2.11	8.90	21.03	20.72
Sebungwe—				
Gokwe	41	2.32	15.35	25.55
ZONE B.:				
Belingwe—				
Bickwell	20	06	12.24	19.20
Bubje Ranch	07	...	...	18.90

RAINFALL—(Continued).

STATION	1922.		Total to end of period.	Normal rainfall to end of period.
	Jan.	Feb.		
Zone B.—(Continued)				
Bulalima—				
Garth ...	·03	·88	9·59	22·40
Retreat ...	·92	1·21	9·65	17·96
Tjankwa (Syringa) ...	·10	...	...	20·10
Tjompanie ...	·76	2·78	13·16	20·32
Gwanda—				
Gwanda Gaol ...	·02	·41	9·45	17·74
Mtshabezi Mission ...	·06	·17	8·67	18·72
Tuli ...	·67	·12	9·27	12·17
Insiza—				
Albany ...	·58	1·30	11·46	17·75
Filabusi ...	...	...	...	18·70
Fort Rixon ...	·13	·41	11·41	18·72
Infiningwe ...	·19	...	...	21·95
Inyezi ...	·03	...	...	17·95
Matobo—				
Holly's Hope ...	·17	·81	8·96	17·79
Rhodes Matopo Park ...	·35	·51	10·17	19·61
Umzingwane—				
Essexvale ...	·04	·75	9·93	19·94
ZONE C.:				
Charter—				
Bushy Park ...	·43	3·36	14·39	22·34
Enkeldoorn ...	·29	3·26	21·37	24·31
Marshbrook ...	·07	3·50	18·46	25·00
Range ...	·12	3·21	19·45	26·23
Umnati ...	·50	1·80	12·86	19·92
Vrede ...	·42	1·87	12·52	23·48
Chilimanzi—				
Wylde Grove ...	·25	1·25	18·17	21·90
Gwelo—				
Cross Roads ...	·44	·99	14·44	21·70
Globe and Phoenix Mine ...	·84	1·26	16·96	24·00
Rhodesdale Ranch ...	·65	3·27	14·60	22·00
Woodenhove ...	·55	1·97	13·58	24·36
Gwelo (Gaol) ...	·46	·68	12·56	22·26
Hartley—				
Ardgowan ...	·67	3·37	24·25	25·70
Beatrice... ..	·17	4·68	19·48	24·10
Carnock ...	·30	3·55	16·26	25·72
Philiphauqh ...	·31	2·94	20·13	27·98
Cromdale ...	·91	3·70	14·53	...
Elvington ...	·47	1·26	15·99	27·38
Gatooma ...	1·02	2·23	18·92	26·93
Gowerlands ...	·37	2·38	15·65	25·20
Hallingbury ...	·64	3·32	16·54	23·85
Hartley Gaol ...	·64	3·17	17·57	27·60
Jenkinstown ...	·57	3·78	19·44	25·02
Nyagordi ...	·27	...	...	25·50
Ranwick ...	1·23	2·03	18·31	25·60
Spitzkop ...	·19	1·68	16·07	25·90

RAINFALL (*Continued*).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Jan.	Feb.		
ZONE C.—(Continued)				
Lomagundi—				
Argyle	·63	5·39	20·77	28·18
Darwendale	2·58	4·92	17·38	25·71
Gambuli	1·43	5·16	19·37	31·20
Lone Cow Estate	1·20	6·11	21·01	28·24
Maningwa	1·14	2·78	17·92	29·83
Mrindagomo	·95	5·51	16·86	...
Mukwe River Ranch	1·55	5·17	19·71	26·04
Palm Tree Farm	1·55	6·26	20·48	26 00
Sinoia	·89	4·76	24·25	25·46
Sipolilo	3·65	7·66	22·24	25·81
Talfourd	·78	5·17	17·47	27·95
Salisbury—				
Avondale	1·61	4·29	19·69	27·29
Botanical Experiment Station...	·48	4·63	15·17	27·40
Bromley	·10	2·70	17·91	28·56
Cleveland Dam	·39	4·90	17·67	25·00
Gwebi	·62	6·17	16·08	28·25
Hillside	1·19	4·40	16·15	25·06
Lilfordia	—	4·75	18·52	26·44
Salisbury Gaol	·79	4·74	14·80	26·07
Sebastopol	·13	5·48	17·78	26·45
Stapleford	1·15	6·16	17·65	28·26
Tisbury	·38	4·64	17·52	26·10
Vainona	1·02	4·07	17·69	27·67
Sebungwe—				
Sikombela	·26	2·81	15·85	23·63
ZONE D. :				
Darwin—				
Mount Darwin	2·50	4·02	21·73	25·49
Inyanga—				
Inyanga	·31	·89	14·23	30·75
Rhodes Estate	—	2·73	17·10	29·95
Makoni—				
Eagle's Nest	2·10	·01	14·44	26·23
Wensleydale ... ..	...	1·44	12·28	25·50
Mazoe—				
Benridge	·69	5·76	16·99	28·17
Bindura	1·36	4·94	17·80	27·11
Ceres	·35	7·96	20·07	30 66
Citrus Estate	2·07	6·43	17·71	25·31
Craigengower	1·26	6·61	21·43	28·78
Kilmer	2·48	5 62	19·24	28·61
Kingston	2·17	5·03	23·73	30·27
Mazoe	1·15	5·43	21·08	26·78
Mazoe Dam (centre)	1·13	6·14	18·54	29·84
Omeath	2·91	8·23	18·03	25·50
Ruia	1·28	8·23	18·03	31·51
Ruoko Ranch	2·17	10·60	25·98	26·70
Rustington	2·19	8·13	18·83	25·90
Shamva	1·86	3·95	16·41	26·74

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Jan.	Feb.		
Zone D.—(Continued)				
Mazoe—continued				
Stanley Kop	1·81	5·61	19·18	25·40
Sunnyside	1·30	5·33	10·95	27·96
Teign	2·00	5·77	22·70	29·40
Virginia	1·10	4·99	16·47	25·41
Zombi	2·26	7·98	26·51	30·70
Mrewa—				
Glen Somerset	2·43	3·28	14·43	29·64
Mrewa	1·17	2·90	17·75	29·16
Selous Nek	2·64	1·89	16·60	30·35
Mtoko—				
Makaha	1·62	3·37	13·55	31·03
Mtoko	2·16	4·38	18·12	25·22
Salisbury—				
Glenara	·64	...	...	26·00
Goromonzi	2·28	4·12	18·61	31·59
Borrowdale	1·02	...	...	27·65
Meadows	·86	5·21	19·84	31·40
ZONE E. :				
Charter—				
Buhera	1·37	4·63	20·93	24·64
Chilimanzi—				
Chilimanzi	·49	3·61	16·77	21·51
Driefontein	·53	1·32	16·26	22·46
Felixburg	·25	2·33	19·48	26·20
Grootfontein	·48	1·91	17·29	22·88
Induna Farm	77	2 08	22·03	23·39
Gutu—				
Gutu	·30	2·22	20·85	24·08
M'vimvi Ranch	1·30	2·13	12·28	24·00
Tel-el-Kebir	·32	1·09	14·79	23·26
Gwelo—				
Ballock ... ..	...	...	...	...
Lovers' Walk	·43	·20	12·10	21·48
Oaklands	·31	·94	15·42	24·33
Partridge Farm	·33	1·84	20·03	23·60
Sheep Run Farm	·39	1·44	16·83	23·60
Belingwe—				
Belingwe ... ..	...	..	...	...
Insiza—				
Thornville	·54	...	...	21·64
Inyanga—				
St. Trias' Hill	1·34	2·14	16·41	31·64
Makoni—				
Chimbi Source (Chitora) ..	·74	1·54	11·99	29·21
Craigendoran	·84	2·43	14·53	24·83
Forest Hill	·54	1·29	11·54	29·26
Gorubi Springs	1·09	·93	11·38	30·43
Mona	—	3·04	17·65	28·71
Monte Cassino	·38	1·20	18 62	28·77
Rusape	·22	1·03	13·58	25·24
Springs	·21	...	...	31·58

RAINFALL (*Continued*).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Jan.	Feb.		
ZONE E.—(Continued)				
Marandellas—				
Bonongwe	·16	...	...	24·82
Delta	·34	2·17	14·89	30·95
Land Settlement	·44	2·79	15·07	28·00
Lendy Estates	·32	1·43	16·41	29·40
Marandellas	1·65	1·68	21·15	28·39
Nelson	·08	...	...	25·62
Melsetter—				
Brackenbury	·33	4·60	23·37	37·54
Melsetter	2·16	4·50	22·95	34·35
Tom's Hope	1·12	3·18	23·82	37·34
Ndanga—				
Bikita ... ..	...	...	...	...
Doornfontein	·15	4·07	18·88	27·60
Ndanga	·64	1·62	12·78	31·60
Triangle Ranch	—	·30	5·93	...
Selukwe—				
Hillingdon	·20	1·78	15·82	25·70
Rio	·37	1·71	17·08	24·14
Umtali—				
Gilmerton	·81	1·94	10·57	24·39
Jerain	·66	4·20	13·60	27·30
Mutambara Mission	·41	1·78	13·74	24·82
Odzani Power Station	2·64	4·48	22·34	28·88
Premier Estate	·18	4·34	14·16	25·34
Stapleford	1·35	9·32	42·63	42·10
Umtali (Gaal)	1·03	3·23	9·21	25·87
Victoria—				
Cavan	·27	...	...	22·11
Clipsham	·12	1·52	10·15	24·34
Gokomere	·37	·98	15·26	21·18
Histonhurst	·35	1·33	11·06	...
Makahori Farm	—	1·11	14·22	...
Makorsi River Ranch	—	·50	12·68	27·20
Morgenster Mission	1·08	9·39	22·24	31·77
Riverdene North	·31	4·52	13·88	24·50
Silver Oaks	·20	2·14	12·03	23·69
Stanmore	·22	3·45	14·56	22·30
Summerton	—	1·31	15·14	21·40
Tichidza	1·26	2·29	15·45	27·50
Victoria	·22	2·10	13·72	21·78
ZONE F.:				
Melsetter—				
Chikore	2·98	...	...	37·14
Chipinga	3·97	..	...	36·60
Helvetia	4·13	...	...	45·07
Mount Selinda	1·62	5·56	27·67	44·76
Vermont	2·79	4·97	31·33	49·29
Umtali—				
Hoboken	1·22	3·81	20·54	45·20

— means nil.

... means no return.

(SUBJECT TO ALTERATION)

Name of Association		Place of Meeting	Secretary	1922			
				April	May	June	
Basket Junction ..	..	Basket Hotel	..	1	6	3	
Beatrice District ..	..	Beatrice Hall, Beatrice	..	27	25	29	
Bindura ..	..	Bindura	..	8	13	10	
Bromley ..	..	Bromley	..	6	6	1	
Darwin ..	..	Arcadia Farm and Mt. Darwin Store alternately	..	9	14	11	
Eastern Border (South Melselter) ..	..	Farm Ravenswood	J. W. Giles	..	fixed	dates	
Eastern Districts ..	..	Eastern Hotel	J. R. Adams	8	8	..	
Enterprise ..	..	Actonville Hotel	..	5	3	17	
Felixburg-Guth ..	..	Willard Farm	Mrs. V. J. Freer	5	13	10	
Figtree Branch, E.L. and F.A. ..	..	Figtree Hotel	F. W. Bradshaw	26	24	28	
Gabazi ..	..	Hunyani Drift	A. S. Will	20	18	15	
Gatooma ..	..	Speck's Hotel	A. Kelsey-Harvey	15	20	17	
Graystone ..	..	Shiping's Hotel	E. Seale	..	..	..
Gwanda ..	..	Various farm houses, Shangani	W. Wood	8	13	10	
Hartley ..	..	Royal Hotel, Gwanda	M. K. K. K.	15	..	24	
Headlands ..	..	Hartley	A. C. Edmonstone	22	27	16	
Hunter's Road Farmers and Stockowners ..	..	Headlands	J. de L. Nimmo	..	..	..
Inanga-Shanganl ..	..	Hunter's Road Siding	J. Grewar	18	10	17	
Inyanga ..	..	Huangani	R. W. Twilley	13	16	10	
Inyanga ..	..	Inyanga Estate	R. E. Neale	18	13	16	
Inyanga ..	..	Inyanga	G. H. Eversard	17	15	19	
Lalapansi ..	..	Lalapansi	J. E. Courthope	7	5	2	
Lomogundi ..	..	Sinola	J. G. Clarkson	21	fixed	dates	
Macheke ..	..	Macheke	W. L. McLean	22	19	16	
Makwiro ..	..	Makwiro	..	23	13	10	
Makoni ..	..	Makoni South Farm	J. G. Morkerton	9	6	3	
Marandellas, Northern ..	..	Marandellas Farmers' Hall	L. J. Smith	1	3	8	
Marandellas, Southern ..	..	Various farms	F. N. Gibson	5	3	..	
Mashonaland ..	..	Commercial Hotel, Salisbury	..	6	..	..
Masopo Branch, E.L. and F.A. ..	..	Various farm houses	..	..	..	..
Maseo Central ..	..	Glendale	G. G. Coghill	12	fixed	dates	
Melselter (North) ..	..	Melselter	Mrs. Dudley Davis	14	10	9	
Melselter (North) ..	..	Melselter	J. Harvie	1	12	3	
Midlands Farmers and Stockowners ..	..	Cronley	R. Woodhouse	18	fixed	dates	
Norton and District ..	..	Royal Hotel, Gwelo	M. Danziger	..	16	20	
Norton District ..	..	Farm Summerfield	A. Tulloch	7	fixed	dates	
Qwa Qwa ..	..	Norton Store	W. Wrench	..	..	2	
Qwa Qwa ..	..	Qwa Qwa	E. Graham	15	fixed	dates	
Rhodesian Landowners and Farmers ..	..	Qwa Qwa	E. R. R.	..	20	17	
Selous ..	..	Library Buildings, Bulawayo	H. S. Hopkins	15	20	17	
Selukwe ..	..	Various farms	C. C. Douglas	..	..	..
Shamva ..	..	Selukwe	W. T. Simpson	..	fixed	dates	
Shamva ..	..	Shamva	A. Musson	20	18	15	
Unvutwe ..	..	Various ranches	Mrs. M. A. Bracewell	13	13	17	
Unvutwe ..	..	Rossmore Hotel, Umtali	M. S. Holland	..	..	1	
Unvutwe ..	..	Unvutwe	M. W. M.	29	27	24	
Victoria ..	..	Victoria	W. P. N. Thornton	7	13	10	
Victoria ..	..	Victoria	W. R. Goucher	8	6	3	
Victoria ..	..	Pine-tree Hotel	..	..	..	..

Farming Calendar.

April.

BEE-KEEPING.

Where numbers of the bee-louse are seen attaching themselves to the legs of bees and also among the quilts which cover the frames, this pest can be controlled by crushing them with the finger. In the cooler districts, crates that are partially filled with honey should be removed, and into the lift which they occupied plenty of warm clothing should be snugly packed.

CITRUS FRUITS.

During the early part of this month autumn budding can still be performed if sap is still up; in fact, if the season is late this operation is better done a little late than early, as in the event of late rains occurring, followed by a warm spell, the buds are liable to start growing, but are soon checked, the result of which is usually a stunted tree. Water by irrigation should be supplied to bearing orchards, unless unusual soaking rains have fallen late in season, followed by thorough cultivation and hoeing around trees. Continual watch must still be maintained for fruit-eating and codling moths. Spraying or fumigating against insect or other pests should not be neglected. Some early varieties may be expected to be ripening towards the end of this month.

CROPS.

The rains are practically over by this month, and the harvesting of early crops, such as buckwheat, linseed, teff grass and manna, will commence. The silo pit should be got ready, and the making of ensilage should be undertaken during this month. The cutting of veld hay for feeding should be completed by the end of the month. The mower, however, should be kept going, and the later cuttings should be utilised for litter in the kraals. All lands that are available should be ploughed. The preparation of vleis for winter crops should be continued, and late varieties such as Algerian oats should be sown this month; also barley for an early green crop.

DAIRYING.

The milking kraal at this season of the year is generally far from clean, on account of the rain. By cows getting covered in mud from the kraal, and subsequently being rubbed off during the process of milking, the milk becomes highly contaminated with numerous species of bacteria. These bacteria, or germs, are the cause of nearly all the trouble in butter and cheese making which arises at this period of the year, i.e., during the wet season. To prevent the same, cows should be milked in a dry place, free from dust. If the udders are found to be dirty just previous to milking, then the milker should clean the affected parts, as the udder, flanks, etc., with a cloth which has been wrung out in clean cold water—the udder should not be washed. The milker's hands should also be washed after each cow is milked. This all spells labour to certain people, but means all the difference between the production of first grade cream and third grade, or a saleable cheese and a non-saleable cheese. In the cheese-curing room, dampness is often prevalent during the wet season,

with the result that the cheeses are often covered with green and white mould. This cannot altogether be prevented unless a properly constructed room is available, therefore wipe each cheese with a cloth every day, and the shelves should be scrubbed once a week with hot water to which a handful of washing soda has been added, and when dry should again be washed with water to which has been added a few crystals of permanganate of potash. The cheeses may also be wiped with a cloth dipped in the same water.

DECIDUOUS FRUITS.

Orders should be given to the nurseryman for trees required in August, September or October. Trees will be lifted in August, and may with advantage be kept in cool storage till required.

ENTOMOLOGICAL.

Maize.—"Earworms" are sometimes troublesome in the tassels and ends of the cobs, but this pest cannot be directly attacked. Caterpillars may attack the crop, on account of their food being suddenly destroyed by late cultivation after the weeds have been allowed to get too far ahead.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt.

Potatoes.—Should be systematically cultivated and hilled, to keep tuber moth from tubers.

Cabbage Family.—Plants of this family are liable to suffer severely from cabbage louse and Bagrada bug.

Beans and Cowpeas.—Insect attack on these plants is but little obvious during April.

Dhal.—Suffers much from blister beetles destroying the blossom during April. Hand picking is the only remedy.

Citrus Trees.—Collect and destroy infested fruit, to keep down citrus codling.

FLOWER GARDEN.

The rains of March have brightened up the flower gardens wonderfully, and at this period of the year they should be bright and gay with autumn flowers. The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

FORESTRY.

If any seed has been sown during the previous month the resulting seedlings should be pricked out into tins.

Young trees planted during the season should be looked over, and where double leaders have developed reduce to single stems. Any abnormal branches should be shortened. The same remark applies to trees planted during the previous season. The object sought to be attained is well grown trees of single stems free from heavy branches.

Operations for protecting woods from fire should be put in hand.

Breaking up of new land should be continued where further tree planting operations are contemplated.

POULTRY.

Breeding pens should ere this not only have been mated up, but the first chicks should have been hatched; the early ones always mature

more quickly and make better birds than the later ones. From the time the chicks are 48 hours old till they reach maturity, do not stint them in anything, either food, milk, care, cleanliness, housing, etc. Remember that growing stock must have food to produce bone, flesh, fat, feathers, to renew waste and compensate for wear and tear and energy. Don't stint chopped-up onions with young chicks; they encourage growth, are a tonic, and prevent worms and colds. An ample supply of thick milk is most beneficial to the health and growth of chicks. Beware of overcrowding; more chicks die from this cause than from any other.

Commence hatching as many turkey eggs as possible.

Those who are growing sunflowers should pick off all leaves except four or five at the top, and dry, sift and powder, thus producing sunflower leaf meal, which is an excellent green food when others are scarce to mix with the dry mash. Munga having risen in price, substitute sunflower seeds or kaffir corn crushed small. If buckwheat is given, it too should be cracked.

STOCK.

Cattle.—Cattle on the ranch should require little attention beyond dipping. Bulls should be kept out of the herd if January calves are not desired, and care should be taken to see that they are thriving and gaining condition for service again next month.

Towards the end of the month dairy cattle in most districts will begin to require some supplementary food. A small ration of maize if the price permits will be advantageous, but in any case they will repay some extra succulence such as Napier fodder, green maize stalks or ensilage, if any of the latter is left over from the previous year. The same applies to calves; and indeed supplementary food should be given to all dairy stock the moment they shew signs of falling off in condition. An early start tends to lessen the total amount of food required during the winter. All preparations for making ensilage should be completed by the end of the month. Any hay-making left undone should be attended to without delay. Attention should be given to water supplies for winter, and arrangements made to prevent water holes, etc., being trodden in as the supply shortens.

Sheep.—If grass seeds are troublesome, an area should be mown for grazing. The vleis should be avoided. It will probably be wise to keep the rams out of the flock for another month, so that lambs will not appear before October, when one may reasonably expect some grazing. This, however, is a matter for individual judgment in accordance with the nature of one's own farm or district.

TOBACCO.

Curing will be continued during the month. Care must be taken to yellow the leaf well before drying out. All bales or bulks of cured tobacco should be carefully examined weekly to ascertain the keeping condition of the leaf. Seed heads should be removed when the pods are brown and stored in a cool dry room. Lands should be ploughed and harrowed as soon as all tobacco has been removed.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided

and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

VETERINARY.

Horse-sickness will be prevalent this month, as will blue tongue in sheep. The first symptom in the latter is laminitis, the second a protruding blue tongue.

WEATHER.

Along the higher ridges of the country we may still look for an inch of rain, more or less, during the month, though little, if any, can be expected in the Zambesi and Limpopo valleys and all low-lying parts of the country. As often as not, however, April is a dry month. In past years it has occasionally happened that early frosts have been recorded which put an end to the tobacco harvest, and may kill tender vegetables and flowers; but, as a rule, no such calamity need yet be expected, and if at all, only in frosty hollows.

May.

BEE-KEEPING.

The scarce supply of nectar, due to conditions of drought, will be responsible for a deficiency of stores. Where this is noticed, steps must at once be taken to supply the bees with artificial food in the shape of syrup. A feeder must be placed above the frames inside the hive. Never feed bees outside, as it promotes robbing.

CITRUS FRUITS.

Continue irrigating bearing orchards up to within three weeks of picking fruit, followed by cultivation and hand hoeing. The same remarks as in April apply concerning insect pests, etc. Washington Navel oranges will be ripening this month, and possibly some early ripening seedlings.

CROPS.

Some maize should be ready for cutting and stooking. Ploughing should be continued on all available lands. Winter crops in vleis, such as Early Gluyas and other wheats, oats and barley, should all be sown not later than this month. Napier fodder may still be cut for ensilage, and this will give time for a considerable after-growth, which can serve as winter pasture.

DAIRYING.

(See April.)

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse and *Bagrada* bug during May. For the former, spray with soap and tobacco wash, which may help if the plants are not too big.

Dhal.—Blister beetles are still injurious to the blossom of the crop, and should be regularly collected and destroyed.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus codling.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted.

FORESTRY.

Continue pricking out seedlings into tins. Deciduous trees which are propagated by means of cuttings should be taken in hand.

See that the fire lines are in order, and in the case of woods which have formed canopy remove inflammable material below the edge trees.

Place orders for any trees proposed to be planted during the ensuing season, so that nurserymen may make provision.

POULTRY.

It will now be possible to tell the sex of those chicks hatched at the commencement of last month. Separate the cockerels from the pullets. Go over the cockerels and select a few of the sturdiest, the ones with the deep bodies and round heads, and those which grow quickest; these will make the best breeding birds and should be kept. The remainder should either be killed and used for making chicken pie, or fed a fattening ration and got off to market as soon as possible.

Beware of allowing young turkeys to become wet; it is fatal to them. Their chief food should consist of chopped-up onions or onion tops and thick separated milk. They should be fed in the same way as chickens, that is, dry food, small grain and plenty of green food and thick separated milk.

Those going in for ducks should hatch as many as possible, and get them out in relays every three to four weeks; give all the food they will eat from the time they are hatched. A quick growing duck should put on 1 lb. per week, and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the main wing feathers commence to grow.

The poultry keeper should never chop and change treatment in any way. If the birds are doing well on a certain menu, it should not be altered; if not, make the change gradually. Sudden changes in surroundings, houses, food, etc., always put the birds off the lay; it is much easier to stop a bird laying than to bring her on again. Poultry keepers and farmers should not wait for the market to come to them, nor expect to sell all their eggs locally at good prices. Small places are soon overstocked with eggs, but try to find markets further afield by advertising and applying direct to hotels, boarding houses, etc.

STOCK.

Cattle.—Ranching cattle may still be expected to be in good condition. In most districts it will be wise to conserve hay, maize stover, ensilage and a supply of any other cheap feed as a provision against possible late rains in the spring, and to enable one to maintain the younger or very old stock should occasion arise. By the middle of this month dairy cattle will require more serious attention in the matter of feed, and in this connection we would refer our readers to Bulletin No. 345. Grass should be cut for bedding and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies and care taken that they are clean and sufficient.

Sheep.—The vleis having dried, sheep may be allowed into the lower lying veld. If the rams are put in now, lambs will arrive in October, which is usually a good month to arrange for. Those who favour winter lambs and have ewes lambing now will find a few handfuls of maize, together with chopped maize stalks or any other kind of available roughage or green stuff, a great help to the ewes in providing milk. (See Bulletin 287.)

TOBACCO.

Curing should be finished as early in the month as possible, to prevent loss from frost. The bales or bulks of cured tobacco should be examined weekly until sent to the warehouse. Tobacco seed should be shelled as soon as the seed pods are dry, and the seed carefully labelled and stored. All tobacco lands should be ploughed and harrowed.

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

The dry season should have now set in, though averages of from a quarter of an inch to three-quarters are indicated in the official reports. Ground frosts at night have been recorded, but are very unusual.

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

CO-OPERATIVE EXPERIMENTS.

WINTER CEREALS.

With a view to promoting the growing of winter cereals, both under irrigation and on vlei soils, and also of introducing new varieties which may prove superior to those at present grown, it is anticipated that the following varieties will be available for free distribution in small quantities from the beginning of March onwards:—

Wheat.—Early Gluyas, Early Australian, Klein Koren, Wol Koren, Lang Koren, Black Persian.

Barley.—Smyrna—malting type.

Oats.—Boer and Burt.

Rye.—Cape Early.

Emmer.

At the date of going to press it is not certain that all the above varieties will be obtainable. In any case, stocks are limited, and not more than three parcels of seed can be sent to any one applicant.

All applications should be addressed to the *Chief Agriculturist and Botanist, Department of Agriculture, Salisbury*.

The terms under which seeds are issued for co-operative experiments are as follows:—

“That the recipient is required at the close of the season to forward to the Department of Agriculture, on forms supplied for that purpose, an accurate report on the result of his experiments with any seeds or plants supplied to him as a free issue.”

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 170. Production of Pedigree Seed—Maize, by H. Godfrey Mundy, F.L.S.
- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 252. Cultural Notes on Buckwheat, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 293. Some Useful Crops for Granite Veld Farms, by R. C. Simmons.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 396. Export of Maize.

- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.
- No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 400. Soil Washing, by A. C. Jennings, Assoc.Mem.Inst.C.E.
- No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
- No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia.
- No. 408. The Velvet Bean, by J. A. T. Walters, B.A.
Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
- No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
- No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
- No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
- No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
- No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
- No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
- No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
- No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
- No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
- No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
- No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.
- No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
- No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
- No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.

TOBACCO.

- No. 132. Sumatra Tobacco, Hints to Rhodesian Growers, by C. J. Sketchley.
- No. 144. Rhodesian Tobacco—Prospects of an Australian Market, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 333. Tobacco Culture—Field Operations, by H. W. Taylor, B.Agr.
- No. 339. Tobacco Culture; Harvesting and Curing, by H. W. Taylor, B.Agr.
- No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
- No. 347. Tobacco Pests of Rhodesia, by R. W. Jack, F.E.S.
- No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
- No. 398. Wildfire and Angular Spot.
- No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision), by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.
- No. 410. Common Mistakes in Growing and Handling Virginia Tobacco, by H. W. Taylor, B.Agr.
Handbook of Tobacco Culture for Planters in Southern Rhodesia, price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
- No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 247. Statistical Returns of Crops grown by Europeans in Southern Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S., Statistician.
- No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
- No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.
- No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia, 1919-1920, by H. C. K. Fynn.
- No. 393. Statistics of Live Stock and Animal Produce for 1920, by H. C. K. Fynn.
- No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia for the season 1920-21, by H. C. K. Fynn.

LIVE STOCK.

- No. 123. Feeding and Care of Imported Bulls, by R. C. Simmons.
 - No. 208. Water in the Diet of Live Stock, by Ll. E. W. Bevan, M.R.C.V.S.
 - No. 227. An Experiment in Beef Production, by R. C. Simmons.
 - No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
 - No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by A. G. Holborow, F.I.C., Assistant Government Agricultural Chemist.
 - No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
 - No. 255. Pound Fees.
 - No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed Farms, by R. C. Simmons.
 - No. 292. Branding and Drafting Pens, by R. C. Simmons.
 - No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
 - No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
 - No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
 - No. 336. Butchering and Flaying.
 - No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
 - No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.
 - No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
 - No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.
-
- Arsenite Cattle Dip—How to Mix.

DAIRYING.

- No. 243. Shedding for Milch Cows, by R. C. Simmons.
 No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.
 No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
 No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
 No. 356. Cream and its Production, by T. Hamilton.
 No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 395. Farm Butter Making, by T. Hamilton, M.A., N.D.D., N.D.A.
 No. 401. Milk Records and Milk Testing, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
 No. 121. Rabies, by Ll. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
 No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
 No. 202. Distomatosis or Liver Fluke in Cattle and Sheep, by Rowland Williams, M.R.C.V.S.
 No. 289. Contagious Abortion in Cattle, by Sir Arnold Theiler, K.C.M.G.
 No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.
 No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by Ll. E. W. Bevan, M.R.C.V.S.
 No. 324. Infectious Abortion of Cattle, by Ll. E. W. Bevan, M.R.C.V.S. Services of Government Veterinary Surgeons.
 No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.
 No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.
 Redwater Treatment and Gall Sickness.

IRRIGATION.

- No. 186. Concrete and Reinforced Concrete, by E. Hardcastle, M.I.E.E.
 No. 206. Hints on Irrigation: Small Earthen Storage Reservoirs, by W. M. Watt.
 No. 270. Odzani River Irrigation Scheme, by W. M. Watt.
 No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.
 No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
 No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.
 No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.
 No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
 Engineering Advice.

FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.
 No. 217. Windbreaks and Hedges, by F. B. Willoughby.
 No. 234. Eucalypts suitable to Southern Rhodesia, and how to Grow them, by F. B. Willoughby.

- No. 267. *Trees for Farm and Ornamental Purposes*, by W. E. Dowsett.
No. 366. *The Management of Woods*, by J. S. Henkel.
No. 379. *Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds*.
No. 386. *Forestry in Rhodesia: Improvement Fellings on the Farm*, by J. S. Henkel.

HORTICULTURE.

- No. 75. *Fumigation of Fruit Trees with Hydrocyanic Acid Gas*, by R. W. Jack, F.E.S.
No. 354. *The Home Orchard*, by A. G. Turner.

ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. *Termites, or "White Ants,"* by Rupert W. Jack, F.E.S.
No. 147. *Root Gallworm*, by R. W. Jack, F.E.S.
No. 158. *Two Ladybirds Injurious to Potato Plants*, by R. W. Jack, F.E.S.
No. 171. *The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants*, by R. W. Jack, F.E.S.
No. 172. *Diseases of the Potato Tuber and the Selection of Sound Seed*, by R. W. Jack, F.E.S.
No. 178. *Illustrations of Natural Forest in relation to Tsetse Fly*, by R. W. Jack, F.E.S.
No. 187. *The Dusty Surface Beetle*, by Rupert W. Jack, F.E.S.
No. 197. *Chafer Beetles*, by R. W. Jack, F.E.S.
No. 204. *Some Injurious Caterpillars*, by R. W. Jack, F.E.S.
No. 214. *Some Household Insects*, by R. Lowe Thompson, B.A.
No. 219. *More Household Insects*, by R. Lowe Thompson, B.A.
No. 233. *Does it Pay to Spray Potatoes in Southern Rhodesia?* by Rupert W. Jack, F.E.S.
No. 249. *Home-made Fly Papers*, by Rupert W. Jack, F.E.S., Government Entomologist.
No. 261. *Turnip Sawfly*, by R. W. Jack, F.E.S.
No. 276. *The Maize Stalk Borer*, by Rupert W. Jack, F.E.S.
No. 280. *The Maize Beetle*, by R. W. Jack, F.E.S.
No. 290. *Notes on Remedies for Turnip Sawfly*, by Rupert W. Jack, F.E.S.
No. 291. *Cutworms*, by Rupert W. Jack, F.E.S.
No. 302. *A Note on the Maize Stalk Borer*, by Rupert W. Jack, F.E.S.
No. 317. *Maize Culture on Red Soil; Value of Poisoned Bait as an Aid to Good Stands*, by Rupert W. Jack, F.E.S.
No. 353. *Further Experiments with Poisoned Bait on Maize Lands*, by R. W. Jack, F.E.S.
No. 369. *The Bean Stem Weevil*, by R. W. Jack, F.E.S.
No. 385. *The Common Fruit Beetle*, by R. W. Jack, F.E.S.
No. 402. *Ticks Infesting Domestic Animals in Southern Rhodesia*, by R. W. Jack, F.E.S.

POULTRY.

- No. 371. *Ducks*, by A. Little.
No. 377. *The Fowl Tick*, by A. Little.
No. 390. *Poultry Husbandry: The Incubation and Rearing of Chicks*, by A. Little.
No. 406. *The Turkey*, by A. Little.
No. 415. *Mating for Improvement and Increased Egg Production*, by A. Little.

MISCELLANEOUS.

- No. 93. Formation of Agricultural Credit Associations in Rhodesia, by Loudon M. Douglas, F.R.S.E.
- No. 129. How to Make Use of the "Fencing Ordinance, 1904," by N. H. Chataway.
- No. 226. Classification of Clouds, by R. H. Scott, F.R.S.
- No. 254. Hints on Explosives, by W. M. Watt.
- No. 264. Nature Notes—Adaptation, by C. F. M. Swynnerton, F.L.S.
- No. 273. Enkeldoorn Produce Express Syndicate Rules.
- No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.
- No. 283. Maize Foods for the Home.
- No. 294. Directions for taking Samples for Analysis, by E. V. Flack, Acting Agricultural Chemist.
- No. 318. Notes on Mining Law for Farmers, by Advocate D. E. McCausland, M.A., LL.B.
- No. 358. Notes on the Regulations governing the Sale of Fertilisers and Farm Foods, by E. V. Flack.
- No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
- No. 391. Hints on Brickmaking, by G. T. Dyke.
- No. 414. Limestones in Southern Rhodesia, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- Malarial Fever: How it is caused and how it may be prevented, by Sir Ronald Ross, F.R.C.S., D.Sc., LL.D., F.R.S., K.C.B., etc.
- Directory of Rhodesian Farmers and Ranchers.
- The Analyses of Agricultural Products, Soils, Water, etc.
- Lectures for Farmers.

Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 41 of 1922.]

[27th January, 1922

HIS Honour the Administrator in Council has been pleased, under the powers vested in him by section 5 (6) (e) of the "Animals Diseases Consolidation Ordinance, 1904," to approve of a fee of two shillings and sixpence per head, payable in respect of the following, viz. :—

1. Every application of the mallein test to horses, mules and donkeys imported into Southern Rhodesia under the provisions of sections 5, 6, and 7 of Government Notice No. 364 of 1914.

2. Every application of the mallein test for export purposes.

3. Every application of the tuberculin test to cattle under the provisions of section 4 of Government Notice No. 407 of 1920.

4. Every application of the tuberculin test for export purposes.

5. All fees shall become due and payable at the time of the application of the test or tests, and the Inspector or Sub-Inspector in charge of the animals may detain such animals at the owner's expense until the fees have been paid.

No. 42 of 1922.]

[27th January, 1922.

HIS Honour the Administrator has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 23 of 1917, appointing Cattle Rangers for the district of Hartley.

No. 109 of 1922.]

[17th March, 1922.

HIS Honour the Acting Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 291 of 1921, and, in terms of section 17 of Government Notice No. 21 of 1917, declare the following area of infection in lieu thereof :—

MAZOE NATIVE DISTRICT.

Area of Infection.

Sleamish, Virginia and Virginia Extension.

Nos. 75, 104 and 110.]

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.

IT is hereby notified that the following applications have been made for authority to use water :—

Name of applicant.	Farm.	Native district of	From what river.	Nature of application.	Purpose for which required.	Period for objection.
Riversdale Estates Synd., Limited	Sub-divisions 6, 7 and 8 of Glengrey	Mazoe ...	Umrodzi ...	To divert public water	To irrigate 350 acres	Two months from 17-2-22
C. Boyd-Clark	Castle Zonga	Makoni ...	Unnamed stream rising on Castle Zonga	To divert public water	To irrigate 6 acres...	Six weeks from 10-3-22
John Meikle	Untali-Embeza	Untali ...	Embeza ...	To divert public water to generate power	To drive a mealie mill	Six weeks from 17-3-22
P. A. Wise	Mimosa ...	Lomagundi	M'lembe	To divert public water	To irrigate 40 acres	Six weeks from 17-3-22

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within the periods above specified from the dates hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of these applications, together with a full statement of the grounds for such objections.

No. 103 of 1922.]

[10th March, 1922.

IT is hereby notified that His Honour the Administrator has been pleased, under and by virtue of the powers conferred upon him by the "Importation of Plants Regulation Ordinance, 1904," to cancel the prohibition prescribed by Government Notice No. 87 of 1919 in so far as it applies to the introduction into Southern Rhodesia of citrus trees grown by registered nurserymen in the Province of the Cape of Good Hope and the Province of Natal of the Union of South Africa, and to approve of the importation of citrus trees as aforesaid under the authority of a permit, the granting of which shall be at the discretion of the Director of Agriculture, who may attach such conditions to the importation as he may deem desirable.

Any person guilty of a contravention of any of the conditions imposed upon any permit granted in terms hereof shall be liable to a fine not exceeding £10.

No. 72 of 1922.]

[17th February, 1922.

IT is hereby notified that His Honour the Administrator has been pleased, under and by virtue of the powers conferred upon him by the "Importation of Plants Regulation Ordinance, 1904," to prohibit, from and after the date of this notice, the introduction into Southern Rhodesia from the Union of South Africa of tobacco leaf, except under the authority of a permit, the granting of which shall be at the discretion of the Director of Agriculture, who may attach such conditions to the importation as he may deem desirable.

Any person guilty of a contravention of the provisions of this regulation, or of any of the conditions imposed upon any permit granted in terms thereof, shall be liable to a fine not exceeding £10.

RHODESIA Agricultural Journal.

ISSUED BY
The Department of Agriculture,
SALISBURY, RHODESIA.

ADVERTISEMENTS.

The Journal is issued every alternate month.

Application for advertising space should be addressed to the Editor. The rates are as follows, *per issue* :—

Position.	Whole page.			Half page.			Quarter page.		
	£	s.	d.	£	s.	d.	£	s.	d.
Inner pages	2	8	0	1	10	0	0	18	0
Outer cover (back)	4	16	0	—	—	—	—	—	—
Inner covers (back and front)									
and page facing Contents	3	12	0	2	2	0	1	4	0

A discount of 10 per cent. will be allowed for standing or consecutive advertisements running through six issues. Remittances, and electros where desired, should accompany orders. The right is reserved to discontinue the insertion of standing or consecutive advertisements should payment beyond the second issue be delayed.

The right of approval of all advertisements by the Director of Agriculture is reserved, and his decision as to the acceptance or rejection is final.

An additional charge may be made for advertisements printed in special type, equal to any additional charges made by the printers for setting up same.

Advertisements will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words.

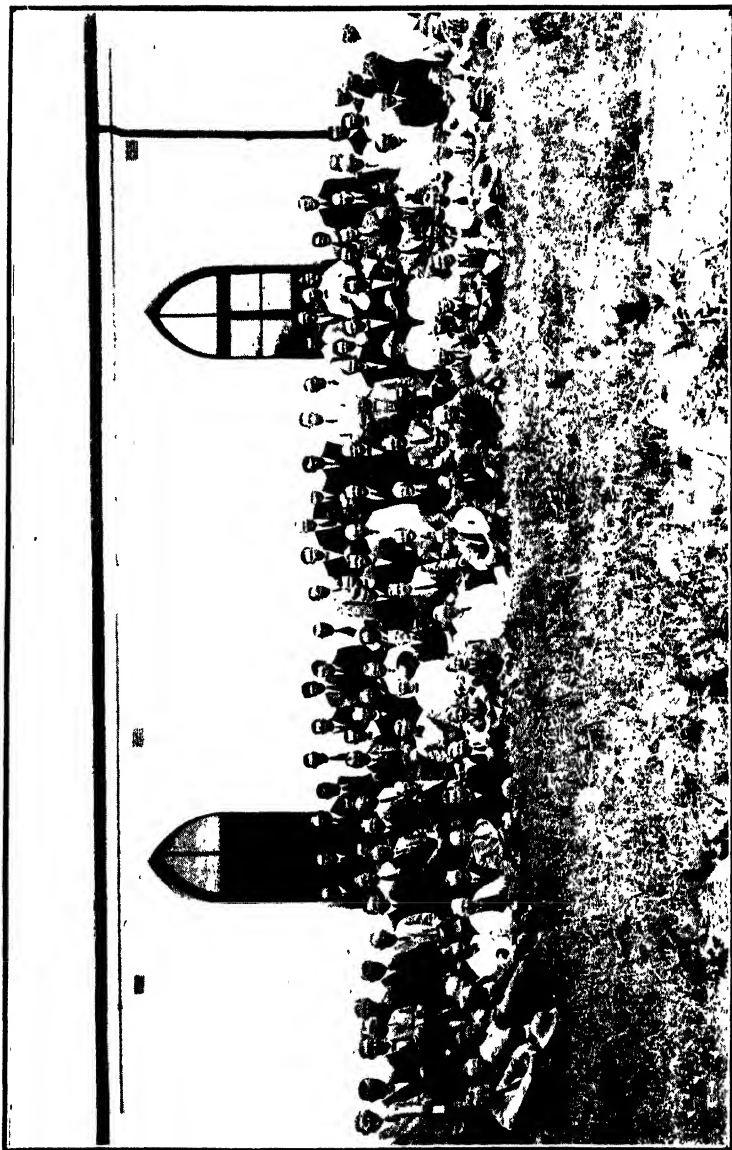


Photo by]
Delegates to the Rhodesia Agricultural Union Congress, Salisbury, March,
1922.

[Messrs. Strachan & Co.



THE RHODESIA Agricultural Journal.

Issued by the Department of Agriculture.

PUBLISHED BI-MONTHLY.

Subscription : 5/- per annum.

VOL. XIX.]

JUNE, 1922.

[No. 3.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

Rhodesia Agricultural Union.—The nineteenth annual Congress of the Agricultural Union met recently in Salisbury. The President's opening speech was generally approved as representing correctly the present state of the situation. It gave a frank and extensive review of present conditions, and was at the same time imbued with a spirit of wholesome optimism for which sound reason was adduced; this provided the keynote for the patient deliberations which followed. The main feature of the discussions—to the exclusion and condensation of much else—was the re-organisation of the Union. A carefully thought-out draft was presented to the members, but it was interesting to find that it was susceptible to considerable modifications after painstaking examination by the delegates.

Far-reaching principles were adopted for the furtherance of the interests of the farming community, and after much discussion, party politics, as distinct from economic questions affecting the country, were strictly excluded.

The question of finance proved to be one of the chief difficulties, and was fully debated, a provisional compromise for one year only being finally reached. It is believed that the re-organisation scheme will tend to increase alike the dignity and efficiency of the Rhodesia Agricultural Union.

The Congress is also to be congratulated on its decision to again send members to serve on the Railway Rates Board, and in this connection there is much to commend the general principle underlying the apparently contradictory idea of fixed railway rates on a sliding scale which was enunciated during this discussion. Numerous other important matters were dealt with, but they were subordinate to the main subject of re-organisation, and suffered accordingly.

Visit to Gwebi Experiment Farm.—Some sixty delegates to the Rhodesia Agricultural Union Congress and other farmers visited the Government experiment farm at Gwebi on the 25th March at the invitation of the Department of Agriculture. The visitors made a systematic inspection of the various crops, and one and all expressed themselves as having spent a most interesting and instructive day. The Department cordially welcomes these visits, recognising that by practical demonstration of this kind its educational work is greatly facilitated. The experiment station at Salisbury, as well as the Gwebi farm, can always be visited, and arrangements will willingly be made for persons interested to inspect the plots. The crops at the Gwebi farm were showing the effects of the drought, but considering the adverse conditions, the stands were remarkably good and an object lesson of the beneficial results of thorough cultivation. The most important experiments in progress at Gwebi are the rotation trials, which occupy 126 acres, each plot being three acres in area. Maize is regarded as the crop of primary importance, and the success or otherwise of all systems of cropping is gauged by its effect on the maize yield. The earliest of these rotations was commenced in 1915-16, the latest in 1919-20, and by 1923 all will have completed one full cycle under uniform cropping and manurial conditions. The results are recorded annually in this *Journal*. Many of the visitors remarked upon the important part which velvet beans as the legume occupy in these trials, and invariably found the reason in the increased vigour of the succeeding crop. Visitors from Matabeleland, in particular, expressed surprise at the wonderful growth of this crop, especially in a season of such light rainfall. The velvet bean is destined to exercise a most beneficial effect upon arable farming in this country, and no farmer should fail to test the crop under his own conditions of soil and climate. An article dealing with velvet beans appeared in this *Journal* in February, 1922, and was reprinted as Bulletin No. 408.

The officials in charge of the experiments were well plied with

questions as the party traversed the plots, and it is safe to say that most of the visitors took away some hints for future application. Eleven acres of Sudan grass attracted considerable attention by reason of the excellent growth with a rainfall of less than 15 ins. Two-thirds of this area had been sown broadcast and had given a good cutting of hay in January. At the time of the visit the aftermath was standing about 3 ft. high, and was ready for cutting a second time. The remainder of the field had been sown for seed with a maize planter in drills 3 ft. apart. This had made excellent growth, and should yield a large quantity of seed. Sudan grass is a fine drought-resister, and is especially recommended for Matabeleland.

Many other experiments in progress were viewed with interest, and the results of these will, as stated, be reported upon in due course in this *Journal*. After a lunch, set out under the shade of some well-grown cedrela toona trees near the homestead, speeches by the Director of Agriculture and Mr. J. A. Edmonds engaged the attention of the party. The latter, on behalf of the visitors, expressed thanks for the hospitality received, and referred in very appreciative terms to the work in progress and the efficient manner in which it was being conducted.

The cattle on the farm were inspected after lunch, and much surprise was manifested by farmers from more distant parts of the Territory at the absence of pure-bred stock. Those, however, more conversant with the facts are aware that the Government have never seen their way to provide funds for the purchase of such animals. The grade herd was brought up for inspection, and the condition and growth of both cows and young stock, running all the year round and receiving no extra feeding, bore ample testimony to the excellence of the grazing and the suitability of the farm for pedigree cattle.

The party was well occupied viewing other crop experiments and pasturage trials until late in the afternoon, when it was time to catch the train back to Salisbury.

A Rhodesia Egg Circle.—We are pleased that the efforts to form a Rhodesia egg circle have fructified, and that measures to provide the necessary organisation are well in hand. The meeting of poultry keepers held in Salisbury on the 19th March was not so largely attended as it might have been, considering the importance of the occasion, but the gathering included delegates from most of the country districts, and may be regarded as representative. The scheme was explained by Mr. A. Little, Government Poultry Expert, and there was no dubiety of opinion as to the desirability of forming an egg circle. It now rests with poultry keepers to make the scheme a success by giving it their loyal support. The sum of £300 is required to cover initial expenses, and as soon as this amount is secured the egg circle will be registered as a limited liability company and the scheme proceeded with. The shares are £1 each, a minimum of one share and a maximum of five. Anyone wishing to support the scheme should send cash according to the number of shares required to the hon. secretary *pro tem.*, Mr. Cyril Allen, Box 592, Salisbury.

In the event of a sufficient number of shares not being taken up to enable registration to take place, the money remitted will be returned to the sender. Details of the scheme were published in the Press, and readers will no doubt be fully acquainted with these. The principle in brief is the co-operative marketing of eggs, and members of the egg circle are required to undertake to dispose of all their eggs, with the exception of those needed for home use or for hatching, through the agency of the egg circle. For this purpose depots will be established at various centres where eggs will be tested, graded and either sold locally or sent to another depot for sale. It is suggested that these depots be at Salisbury, Umtali, Que Que, Gwelo, Umvuma and Bulawayo. In addition, there will be collecting stations at as many places as possible where eggs will be received from suppliers and despatched to the nearest depot. A small charge will be made for the services rendered at the depots, but apart from this, the whole amount realised for eggs sent in will go to the supplier. In this way the latter is assured of a fair price for his produce, while in addition he will participate in any profit which may be made on the year's working. In any scheme of this kind the consumer must be protected, and it is, we understand, the intention to fix a price which will be moderate and uniform throughout the year. At the meeting referred to the prices suggested were:—

1st grade	2s. 9d.
2nd grade	2s. 3d.
3rd grade	1s. 6d.

Mr. Little made a good point in his address of increasing the local consumption of eggs. We think that it is within the power of the egg circle to accomplish this, especially if a moderate and uniform price for eggs be maintained.

It will be necessary, however, to increase our output, for Mr. Little showed that if every white person in the Territory ate only two eggs per day the number required would be 24,543,600, whereas our production last year amounted to but 4,261,911 eggs for food purposes. Export would, in the light of these figures, appear to be quite unnecessary for the present. It is, however, necessary to prepare for such an event, and an organisation such as an egg circle is best calculated to serve the interests of the producer.

The proposed articles and memorandum of association and rules of the Rhodesia Egg Circle will shortly be published in the Press, and it is hoped that every one interested will study these carefully and offer any suggestions which will in their opinion make for efficient working.

The Drought.—The unprecedented drought which has been experienced this season over the greater part of the Territory has created a situation which must be regarded as serious. The season, which opened with general and copious rains, failed to fulfil its early promise, and with the exception of Wankie the total rainfall is far below the average. Comparative figures of the seasonal rainfall are



Explaining the manural trials Gwebi Experiment Farm.



Delegates to Rhodesia Agricultural Union Congress at Gwebi Experiment Farm, March, 1922.

given in the Weather Bureau Report which appears towards the end of this *Journal*, and it is not necessary to repeat those here. It will be seen that the shortfall is greater in Mashonaland than it is in Matabeleland, but it must be remembered that the seasonal average is more in Mashonaland, therefore Matabeleland has received less rain as a whole than has Mashonaland, and is the greater sufferer of the two provinces. The water supplies in certain parts of Matabeleland have already given out, and the prospects for the ensuing months before rain can be expected are serious. There are, however, ample supplies of water and of grazing in the Territory as a whole, and the chief problem is how to make use of these to the best advantage. Boring operations have been commenced in certain native reserves, whilst elsewhere natives have been removed to areas where ample supplies of water exist. Where necessary, the feeding of natives is being undertaken by the Government. The railway administration early appreciated the situation, and announced special facilities for the transfer of stock by rail to new pasturage. As from 12th April cattle removed from the drought area are charged half the ordinary charges on the forward journey, and if returned within twelve months they will be conveyed free to the original sending station, providing certain conditions are complied with. Stock born during the time the cattle are away will be carried free to the station or siding from which the herd was originally consigned, unless their conveyance involves the use of extra rolling stock, in which case half rates will be charged. As yet no considerable movement of stock has taken place, but in many cases transfer cannot be long delayed. The Rhodesia Agricultural Union is collecting particulars of areas available for this purpose.

Another aspect of the drought is the great difficulty experienced in obtaining sufficient quantities of hay, particularly in the large towns, and supplies have to be brought from districts situated a considerable distance from the consuming centres. The railway administration have agreed, therefore, as a temporary measure to carry hay conveyed in trucks which otherwise would travel empty between all points in Southern Rhodesia at rates which represent a very considerable reduction on the ordinary tariff charged.

These concessions are an earnest of the desire of the railway administration to help the farming community in this time of stress, and will, we are sure, be fully appreciated. It remains for all stock owners who have not sufficient water or grazing to tide over the winter months to make early arrangements for the removal of their stock. Too much stress cannot be laid on the necessity for preserving the grazing by preventing grass fires which are so apt to occur at this time of the year. If not already done, adequate fire guards should be burnt and every precaution taken to prevent the spread of a fire should it occur.

Locusts in Rhodesia.—The immunity from the visits of locusts which Southern Rhodesia has enjoyed since the year 1910 was broken during the third week in May this year, when large swarms were

reported to have entered the Bulalima-Mangwe and Gwanda districts from the south and south-west. Whether this portends a serious visitation or not time alone can determine, but the Department of Agriculture is closely in touch with the situation, and is taking all practicable measures to deal with the menace.

Seeing that so long a period has elapsed since locusts were last seen in the Territory, it is probable that certain points bearing on the conduct of a campaign against the pest may not be generally known. In the first place, operations against winged swarms have long been recognised as impracticable. It is against the immature, wingless locusts, known as "hoppers" or "voetgangers," that the well-known South African method of destruction by means of poisoned bait is directed. Secondly, an outbreak of "hoppers" is not to be anticipated immediately. Winged locusts entering the Territory during the dry months will tend to range far and wide, and to lay their eggs in the soil in various localities. These eggs will not hatch without moisture, and may be expected to lie dormant in the soil in most localities until the commencement of next rainy season. The proper procedure, therefore, is obviously to collect all information possible concerning the localities where eggs are deposited, to move supplies to such areas, and to make preparations for the destruction of the "hoppers" when they hatch out.

The cordial co-operation of all members of the agricultural community in supplying information is confidently anticipated, and attention may once again be drawn to the provisions of the "Locusts Destruction Ordinance, 1918," under which all occupiers of land are required to report at once to the nearest Magistrate or police station if eggs are deposited or hoppers appear on land for which they are responsible. That the information supplied to the Department be as full and accurate as possible is, for obvious reasons, in the general interest.

Rhodesian Leather.—We publish elsewhere in this issue some notes written by the manager of the Rhodesia Leather Co., Ltd., regarding the flaying, curing and drying of hides. We trust these will be perused carefully by those concerned in the removal and treatment of hides, for at the present time the methods in vogue are, to say the least, crude and wasteful. To produce first-class leather there must be first-class material. The pelt of the Rhodesian cattle hide is as good as is to be found anywhere, but there is little improvement to record in the handling of the hide by the butcher or the farmer. The most serious blemish is the cutting of the hide during the process of flaying, and this and other preventable faults are dealt with in the notes mentioned.

We are pleased to learn that the market for the tannery's products is constantly expanding. At the present time attention is directed principally to the manufacture of sole, harness and pump leather. Sole leather is the chief article in demand, and two varieties are manufactured, viz., the commonly used, vegetable tanned leather and

a mineral tanned leather similar to chrome. The former is mostly in demand, having the characteristics to which the public is accustomed. Orders for this leather are being received from Johannesburg, East London and the Congo, and it is evidently giving satisfaction. The mineral tanned leather is exceedingly durable in wear and absolutely water-proof, qualities which are quickly popularising it. Harness leathers, both brown and black, suitable for repairs, are being turned out in increasing quantities, while pump leather is now used at many Rhodesian mines.

The tannery is effectively establishing itself, and promises to become a factor of some importance in the industrial development of the country. It is deserving of the utmost support, and we therefore hope that whenever possible the public will use Rhodesian tanned leather in preference to imported leather, which is frequently inferior in quality to the local product.

Such adjuncts to the agricultural industry are deserving of support by the farming community.

African Coast Fever.—An outbreak of African Coast Fever occurred last month on the farm Wiltshire, Charter district, the number of deaths to date being considerable. All movement of stock in the district has been suspended, and measures to deal with the outbreak have been taken. The Charter district has hitherto been free from Coast Fever, and its appearance now is most unfortunate. It is to be hoped that the disease will speedily be stamped out and its spread to neighbouring farms prevented. In the Melssetter district a case of the same disease has been diagnosed on a farm adjoining an infected area. Here also prompt and adequate measures have been taken

Customs Returns.—The annual figures for exports of produce of Southern Rhodesia are now available in the Customs Returns for the year 1921, from which the accompanying figures for the value of certain exports are culled:—

Gold	£2,298,596
Asbestos	431,028
Copper	401,947
Maize and maize meal	223,410
Live stock and animal products	205,349
Coal and coke	201,387
Tobacco	196,702
Chrome	81,202
Vegetables	14,354
Wood	13,566
Wheat and flour	8,953
Arsenic	8,411

£4,084,905

From the above tabulation it will be noticed that exports of maize and maize meal rank next after gold, asbestos and copper, although much below the figures for these minerals. Live stock and animal products come next, slightly exceeding the value of coke and coal, which again are nearly equalled by the export of tobacco. The position of arsenic has been included in the tabulation on account of its importance to the agricultural community. In comparing the export of agricultural commodities with minerals it must be recollected that with the exception of a minor amount of coal and arsenic, the entire output of minerals is exported, whereas in the case of farm products it is virtually only the surplus, after our local requirements have been met, that is available for export; thus our production of meat and maize far exceeds our export of these commodities. The item live stock and animal products is made up from the following various elements:—

Slaughter cattle	£77,119
Other live stock	37,009
Fresh meat	2,207
Bacon and ham	10,634
Other meat	9,004
Hides	18,305
Butter	47,165
Sheep skins	2,956
Other skins	950

£205,349

In this connection it is to be noted that the value of the export of slaughter cattle was only £77,119 in 1921, against £235,394 in the previous year—a final rebuttal of the malicious statement circulated in the Union that cattle from Rhodesia were being dumped in the Johannesburg market. The above figures deserve careful scrutiny by all interested in the farming enterprises of this country.

The Budget.—In making his annual budget statement in the Legislative Council the Treasurer referred to certain matters of interest to the farming community. In regard to importations, whilst there were general reductions, there were certain increases which deserved comment. Thus, cattle went up in value to £51,000, as compared with £30,000, an increase of £21,000; and in number from 884 to 1,007. The value indicated that these imports must have consisted almost wholly of good breeding stock, for the average cost of the animals imported from the Union was £36.71 per head, and that of the animals from overseas £291.0 per head. Butter and cheese totalled £19,000 in 1921, compared with £16,000 in 1920, an increase of £3,000. Against that, however, butter to the value of £47,000 was exported from Southern Rhodesia. Dipping fluids were imported to the value of £28,000 in 1921, as against £19,000 in 1920.

In regard to exports, the total value of animals exported amounted to £114,128, as against £312,599 in the previous year, a decrease of £198,471. Similarly, maize and maize meal exports dropped by

£358,000, and hides and skins by £166,000 less than in the previous year, a very notable diminution. Butter increased, however, by £18,000, and tobacco by £45,000.

In a later statement the Treasurer mentioned that the value of exports from the farming industry fell in 1920-21 from £1,000,034 to £358,000, and that was in respect of the main items only, viz., cattle, skins, hides and maize products.

A Settlers' Guide.—We commend to the notice of those who contemplate taking up land in this country a brochure issued recently by the Rhodesian Settlers' Board entitled, "Notes for Prospective Settlers." For the guidance of the stranger to Southern Rhodesia we might state that the Board was created by the Administration, and is constituted of practical farmers of long experience in this country and officials of the Department of Agriculture. The information issued is therefore authoritative and reliable. The Board has local advisory committees in every district of the Territory, and is thus able to answer any enquiry received. The Board is doing useful work, and as the potentialities of this country become better known, its sphere of usefulness will be considerably widened. We would strongly urge anyone who is thinking of settling on the land here to get into communication with the Secretary, whose address is Box 372, Salisbury. The handbook referred to compresses into a small compass information upon every matter germane to the issue. The Board advises, in all cases, a stay of at least a few months in the country before land is purchased or any serious financial responsibility undertaken. To this end the Board is willing on receipt of due notice of the prospective settler's arrival to endeavour to arrange for tuition on a farm. This we consider necessary, for notwithstanding with what experience the settler is armed, the conditions here will be found totally different from those obtaining elsewhere. The Board, it might be mentioned, does not offer land for settlement, but it is able to obtain, by means of its various local committees, reliable information on all properties for sale and to assist prospective settlers to locate and view farms which may be offered to them.

Milk Records.—It is to be regretted that lack of space prevents us from including in our present issue records of milk production by Rhodesian cows during the past two months. These records will be published in the August number.

Several fresh entries have been received, and it is satisfactory to note that the movement is spreading, and that the benefits to be derived from adopting the system of milk recording are being realised. In this connection attention is drawn to an article appearing in this issue entitled, "The use of Pure-bred Sires for Dairy Herds." The effect which the judicious use of pure-bred bulls has upon milk production when combined with a system of milk recording cannot be over-estimated.

Salisbury Show.—The prize lists for the Salisbury Show on the 8th, 9th and 10th August have been issued, and should by now be in the hands of all members of the Rhodesian Agricultural and Horticultural Society. This is the twenty-first annual show of this society, and there is a laudable determination on the part of the committee to make this "coming-of-age" a great success. Railway excursion fares, at single fare for the double journey, will be available for visitors and exhibitors from all parts of the Union of South Africa, Northern and Southern Rhodesia and Portuguese territory, and of course all unsold exhibits will be returned to the point from which they were forwarded free of railway carriage. A great deal has been accomplished in further laying out the show grounds, all to a definite scheme, which will be developed year by year. The ladies' industrial hall committee have again agreed, with their usual enthusiasm, to undertake the whole of the catering at the show, and the whole of the refreshments sold at the show will be for the benefit of their fund. Two well-known breeders from the south have promised to visit Salisbury and bring their cattle exhibits with them, and the Friesland Breeders' Association are again this year sending up a consignment of animals for exhibit and sale. In the cattle section of the prize list there are a number of new trophies and new special prizes. The "Gertrude Page" trophy for the champion female animal has been received. It takes the form of a handsome solid silver tazza of unique design, and will remain a memory to this gifted lady. There is also the new Union-Castle Co.'s silver trophy for the champion two-year-old bull, any breed, and the St. O'Gorman trophy for district competition in cattle. All cattle trophies are accompanied with cash prizes ranging from £50 to £10 for championships or reserve championships, and each breed has a special champion prize ranging from £30 to £10. The cattle committee have created an innovation for all Africa by including females in the slaughter classes, and it is hoped exhibitors will take full advantage of this. In addition to the £25 usually offered for the champion pen of five slaughter animals, there is an additional cash prize of £5 for the champion single slaughter animal, which may be taken from any pen of exhibits. The milking competition is to be held over a period of two days, in place of one day as previously. An item in the cattle section which is already creating the widest interest is a cattle-judging competition for juniors (boys and girls 16 years of age and under). A sum of £15 will be distributed in prizes in this competition, due to the generosity of two gentlemen greatly interested in the society. In the horse section a most attractive list of ring events has been arranged; there are four ladies' events, and there is the new "Buxton" trophy for the champion Rhodesian-bred horse. There is also a cup for the champion hack and another for the champion polo pony. The pig section has been catered for to a greater extent than it was last year. Both the Berkshire and Large Black breeds have championship and reserve championship special cash prizes; and, further, both breeds have championships and reserve championships for Rhodesian-bred animals. There are also special prizes of £5 5s. each for pens of three and six bacon pigs. All the maize prizes have been increased in value,

and there are seven special prizes, while there is a "Koodoo" plough for the champion bag of wheat. Tobacco is fully up to last year's prize schedule, and so is fruit. In the former there are eight special prizes of considerable value. In the industrial hall section the ladies are going to exceed last year's great record. The poultry section has an ambitious programme, and the prizes are very handsome. On the whole the committee and the society are to be congratulated on taking a long view for their important show, and for the confidence they display in publishing a prize list of this very handsome nature at this time.

It is to be hoped that farmers will respond to their utmost ability to the appeal for financial assistance when it is made, for the expense involved in the carrying out of the programme outlined is very considerable. It will be realised, however, that such an event as the Salisbury Show can accomplish much, and that it is in the farmers' own interests to render it all the support they can. The show will be opened by the Rt. Hon. Jan Smuts, and we feel sure that the presence of this distinguished South African will prove a great attraction.

Maize Growers.—It will no doubt come as a surprise to many, especially in view of the fact that the European grown maize in the season 1920-21 amounted to over 1,200,000 bags, to learn that there are under 1,000 maize growers in Rhodesia, excluding from that term persons who grow under 100 bags. The statistical returns collected last year show that there were 963 farmers producing maize in the Territory. Of these, 659 produced between 100 and 1,000 bags each, 252 produced from 1,000 to 5,000 bags, 45 produced from 5,000 to 10,000 bags, and 7 grew over that very large figure.

The returns which have been collected by districts indicate that the large preponderance of producers on a fairly big scale are to be found in the districts of Salisbury, Lomagundi and Mazoe. The Mazoe district contains 107 farmers growing between 1,000 bags and 5,000 bags, only 23 below 1,000 bags and 40 above 5,000 bags, whereas in the other districts mentioned there are relatively a larger number of smaller producers.

From these returns it will be seen that less than half the farmers in the country may be called maize growers, even if this definition is brought down to persons growing as few as 100 bags. The very large total produced last season is more creditable to those who have grown it. Unfortunately their output for this year will be very much less.

The White Poplar.—In Vol. XVII., No. 3, of the *Rhodesia Agricultural Journal* for June, 1920, we published an article by the Forest Officer dealing with two useful soft woods. Reference was made to the small grove of white poplar (*Populus alba*) at the forest

nursery. This grove has been thinned and kept free from weeds, the object in view being not only to stimulate the growth of the trees, but to encourage a growth of suckers for which there is an increasing demand.

The grove at the forest nursery not being of sufficient size, it was decided to extend the area. Owing to the demand for suckers, the only material available were some old stumps and suckers considered unsuitable for sale. These suckers were planted at an espacement of 6 ft. x 6 ft. on an area adjoining the original grove. The suckers were all cut back, leaving stumps projecting 6 inches above the ground. The land before planting had been carefully prepared. The suckers were planted on the 10th February, 1921. After planting, good rains occurred until fairly late in the season. The small plot has been regularly cultivated and kept free from weeds. In order that straight stems may be produced, lateral branches were removed from time to time. The actual dates when these operations were performed were: 25th May, 1921; 22nd December, 1921; and 4th March, 1922.

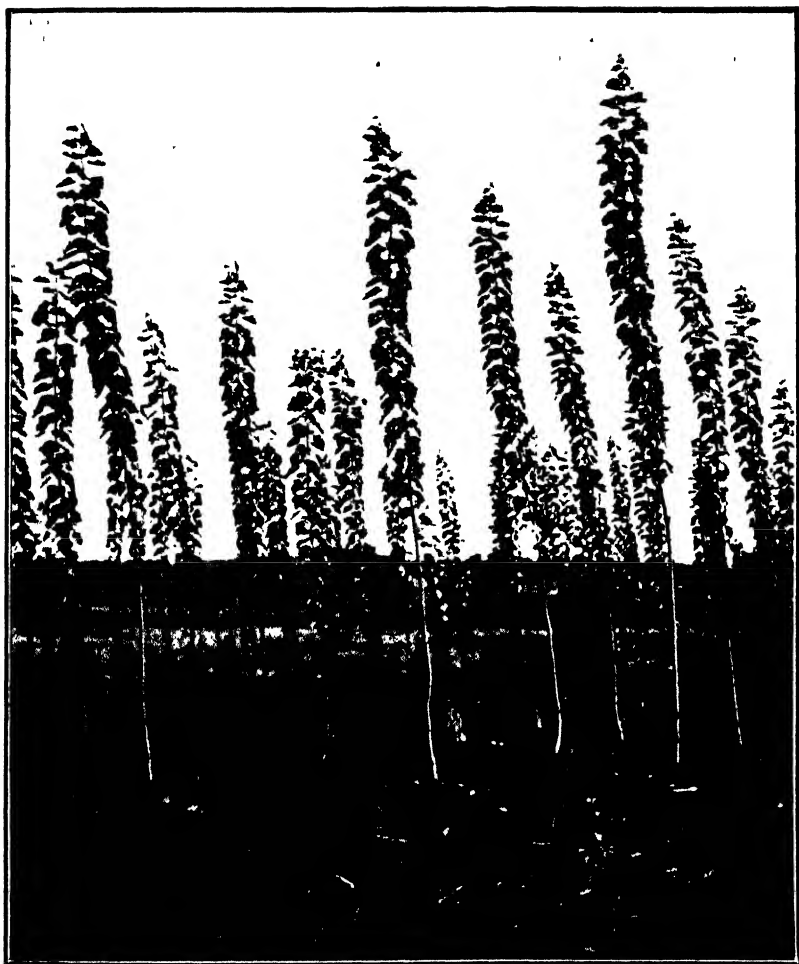
The result obtained is shown in the accompanying photograph, which was taken at the end of April, 1922.

The average height of the young trees is about 13 ft. Quite a number of the stems are 15 ft. high, and occasionally 17 ft. is reached.

The white poplar produces a timber useful for a variety of purposes, and it is confidently asserted that there is scarcely a farm in Southern Rhodesia where some spot in a vlei or along a stream bank cannot be found to establish a grove.

Rusape Show.

The Makoni and Inyanga Districts Agricultural and Horticultural Society is sparing no effort to make a success of its annual show, which is to be held at Rusape on the 23rd and 24th June. A comprehensive and attractive programme has been arranged, and we trust the various classes will be well filled. Entries close on the 16th June.



Young grove of white poplar (*Populus alba*), under fifteen months, at
Forest Nursery, Salisbury.

From Breeder to Butcher.

CATTLE FEEDING EXPERIMENT No. 9.

GOVERNMENT EXPERIMENT FARM, GWEBI.

By ERIC A. NOBBS, Ph.D., B.Sc., F.H.A.S.

As a result of a series of experiments in past years, a system of fattening cattle has been worked out at the Government experiment farm, Gwebi. A standard plan or feeding programme has been reached, and was last year put to trial on a larger scale than previously. The results which are here recorded bear out our previous experience. The figures arrived at may be regarded as a reasonable indication of what may ordinarily be expected on a commercial scale, the average being based on a fairly large number of individual animals. No doubt every farmer going in for stall feeding will have to adapt his treatment to meet his own particular circumstances, using the foods he has available, and such animals as he can best get, and placing them in what kraals or pens he has or can erect, but on the whole he will find the lines here laid down are practicable. Whilst, therefore, there is room for differences in detail, yet there are certain fundamental rules which it will be well briefly to re-state here.

(1) Experience has shown that the better bred the cattle are the better they will respond to artificial feeding. Oxen of beef type and of high grade should be selected, and it will pay better to feed such than native or low-class stock or oxen that have done their time in the yoke. Even amongst grade cattle there is much room for discrimination between those likely to do well and others not of a disposition or build to fatten profitably. In this direction there is much room for the exercise of judgment.

(2) It is possible and proper to fatten cattle on food entirely grown on the farm and without purchasing anything except salt.

(3) The profit on feeding will obviously depend, amongst other things, on the cheapness of the food used, and as far as possible, therefore, the more costly forms are to be avoided, or used sparingly.

(4) The feeding process divides itself conveniently into three periods, and the more rapidly it is carried out the more profitable it

becomes. During the first stage, including the preliminary days of adjustment to their new conditions, when the cattle generally lose weight, there appears to be a far-reaching change taking place within the animal's body, which, without becoming visibly fat, alters considerably in outward form and in the evidences of condition from that of a store or grass-fed beast to that of a stalled animal. Abundant food with a large proportion of roughage is consumed. Before the rate of increase diminishes, as it would do after a time, the diet must be gradually changed, not suddenly, as this would cause a setback.

With cattle of the description used this first stage should not exceed seven weeks, but varies with initial weight, age and character.

During the second period a diet of somewhat higher nutritive value is given with less roughage, and the addition to maize of nitrogenous concentrates such as beans and ground nuts, all fed in the form of meal. Oily food in the form of sunflower and ground nut meal is allowed, and to maintain the appetite a greater variety of foods is given.

This stage lasts about seven weeks also, and is followed by the final fattening process with less maize and more other grain and any available attractive food to induce the nearly prime fed and consequently lazy animals to top off well. After two to three weeks of this treatment the cattle should be sold, as this is the most costly period and cannot be continued indefinitely. As already stated, the more quickly the animals are fattened, consistent with economical diet, the better.

(5) Apart from rations, it is essential to give constant attention to regularity and punctuality in the routine of feeding and watering, to comfort and shelter, cleanliness and quietness, freedom from excitement, such as fright, flies or sight of other cattle.

(6) Complete stalling has been found preferable to grazing during a part of each day and stalling at night.

(7) It is inadvisable to stall-feed cattle whilst the veld is abundant. Hitherto only one lot of cattle has been fattened at the Government farm each winter, but it is proposed as a development of these experiments this winter to fatten two lots, the first commencing about May and finishing probably in the middle of August, and the second beginning in September, after a preliminary period on the old maize and other lands, and finishing probably about Christmas time.

(8) Feeding cattle, like feeding infants or invalids, is in a measure an art acquired by experience and instruction. It is not proposed to attempt here to inculcate the whole procedure, but only to indicate the results of last year's trials.

As in recent years, the cattle employed in these experiments consisted of grade Shorthorn bullocks from the Rhodes Inyanga Estate, three-and-a-half years old, never worked and never previously fed; in fact, typical ranch cattle. Previous to that time grade oxen of various degrees of breeding, old trek oxen and native cattle had been tried.

In the experiments now under consideration, stall-feeding commenced on 10th July, and the first period lasted 51 days, the second 55

days, and the final stage averaged three weeks, the cattle being taken at intervals as they became prime and as required by the butchers. A few were kept longer for the Gwelo Christmas Fat Stock Show. Ordinary stock in store condition should be fattened in sixteen to eighteen weeks, but less if initially in good condition. A few will require a shorter time, and some may take longer to become really prime, a question of disposition or idiosyncrasy. A couple were after probation discarded as unprofitable feeders.

Forty head of bullocks, eight in each pen, were fattened in post and rail yards approximately 21 x 33 ft. square, with lean-to iron roofs to afford shelter and shade. Twenty head, ten in each yard, were fed in rather larger pens erected under the shade of native trees, with roughly thatched roof shelters. The post and rail kraals were erected of native timber and gum and Mauritius hemp poles, and their cost was negligible. Stacks of hay and maize stover were built on the windward side of these pens to provide shelter from the east wind.

Throughout the feeding trial the animals in the pens under the shade of trees appeared more contented, less distressed during the heat of the day, and their live weight gains were quite as good, if not better, than those in pens with iron roofed shelters.

The foodstuffs available at the Gwebi farm comprised veld hay, velvet bean hay, ground nut hay, maize stover, maize silage, maize, velvet beans, ground nuts, sunflower, linseed—the grain all in the form of meal—mangolds, pumpkins, majordas, also small quantities of oat hay, manna hay, teff hay and Sudan grass hay. Manifestly the variety is greater than may be available on many farms, and it is, therefore, to be emphasised that they were used not because all were essential, but because they had been grown on the farm experimentally, and were therefore not only available, but had to be consumed. It would have been quite practicable to have used a smaller variety of feeds. Similarly, certain useful feeds not mentioned above might have been used had they been available, such as Napier fodder, sweet potatoes, field radish, cow peas, dhal and other peas and beans.

Variety is always an advantage, provided new foods are not introduced suddenly and exclusively to animals unfamiliar with them. If fed with discretion, a very few different foods will suffice. The total weight of food actually consumed is shown in Table I. From this return it should not be difficult for anyone, working backwards, to estimate from a knowledge of supplies in hand how many head of stock he can fatten. The great disparity between the quantity of the different foods used becomes apparent. Silage and other succulent feeds, maize and veld hay are the chief commodities needed, whilst meal from beans, ground nuts, sunflower and linseed is used in very limited amount.

During the first feeding period 60 head consumed 132,595 lbs. of food of all kinds in 50 days, an average of 44.2 lbs. per diem; in the second period, lasting 56 days, they ate 199,386 lbs., or 59.3 lbs. per head each; in the concluding period of 46 days the number of cattle averaged 43 head, and they consumed 56.34 lbs. each daily.

TABLE I.

Weight of Food Consumed.

	1st Period.	2nd Period.	3rd Period.	Total.
	Lbs.	Lbs.	Lbs.	Lbs.
Veld hay	30,655	32,910	9,190	72,755
Maize fodder	6,250	7,000	1,945	15,195
Velvet bean, etc., hay ..	14,035	22,575	3,005	39,615
Oat hay	—	—	10,485	10,485
Sudan hay	—	—	13,600	13,600
Silage	32,640	52,085	10,595	95,320
Pumpkins, mangels, etc.	28,200	38,200	21,160	87,560
Maize finely crushed ...	20,315	38,195	29,295	87,805
Bean meal	—	3,748	2,543	6,291
Ground nut meal	—	4,033	3,590	7,623
Sunflower meal	—	140	4,510	4,650
Linseed meal	—	—	1,028	1,028
Salt	500	500	500	1,500
Totals	132,595	199,386	111,446	443,427

The average daily ration given for each period was, therefore, as shown below. Slight fluctuations took place, especially at the end of each period, when the change of diet had to be spread over a few days. The simple ration first used gives way, in the second period, to one containing beans, ground nuts and sunflower meal, whilst pumpkins are largely replaced by the better keeping majordas and more silage is given. In the final period again veld hay is replaced by more palatable oat and Sudan hay; maize is increased, linseed meal added as an attraction, and mangolds (the best keepers of all) replace cattle melons.

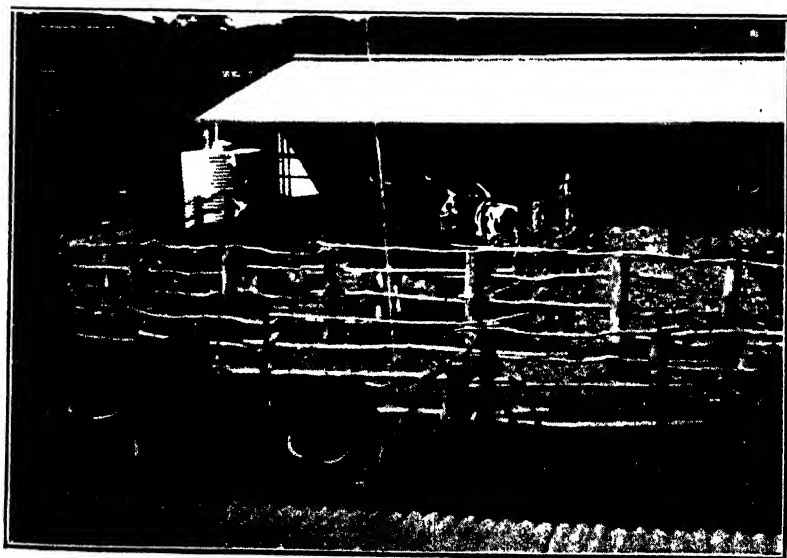
TABLE II.

Daily Rations Consumed in each Period.

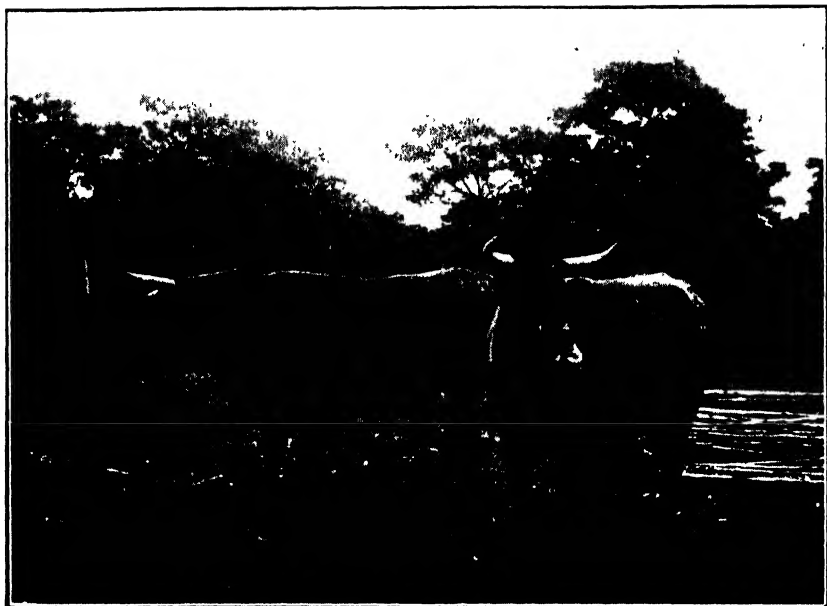
	1st Period.	2nd Period.	3rd Period.
	Lbs.	Lbs.	Lbs.
Veld hay	10.22	9.79	4.64
Maize fodder	2.08	2.08	1
Velvet bean hay	4.68	6.7	1.5
Maize finely crushed	6.77	11.36	14.8
Silage	10.88	15.5	5.35
Pumpkins, majordas, mangolds	9.4	11.37	10.7
Bean meal	—	1.11	1.28
Ground nut meal	—	1.2	1.8
Sunflower meal	—	.04	2.28
Linseed meal	—	—	.52
Oat hay	—	—	5.3
Sudan hay	—	—	6.87



Cattle Feeding Experiment No. 9.



Cattle Feeding Experiment No. 9, Gwebi Farm, showing post and rail kraals.



Cattle Feeding Experiment No. 9.



Cattle Feeding Experiment No. 9, Gwebi Farm, showing cattle at the end of the fattening period.

Actually the amount of maize given during the final period was, owing to a mistake, excessive; it should have been only about 8 lbs. per 1,000 lbs. live weight per diem.

The result of feeding these bullocks in the manner described may be summarised here, premising only that each beast was weighed at the commencement of the experiment and once a week thereafter, the scale of diet being gauged in proportion to the actual weight of each pen for the week and the food changed as indicated by the weekly results.

The increase was not perfectly steady, and it was remarkable to observe how a majority of the animals would go ahead or remain for a week without advance, depending upon weather or other incidental causes. On the whole, however, the increase was good, averaging just 2 lbs. per head per day throughout the period. The total weight of the cattle at the commencement of the experiment was 59,100 lbs., and at the conclusion 74,235 lbs., a total increase of 15,135 lbs., equal to 113 lbs. each day, or 260 lbs. on each beast, which, as the average weight per beast was 1,019 lbs., means an increase of 25.5 per cent. The original weight and that at the end of each period is shown for every animal in Table III. :--

TABLE III.

Weights of each Animal throughout the Experiment.

Original Weight on 10.7.21.	Weight on 29.8.21.	Weight on 24.10.21.	Final Weight.	Date of Final Weight.
Lbs.	Lbs.	Lbs.	Lbs.	
1,005	1,175	1,265	1,385	3.12.21
950	1,095	1,060	1,230	9.12.21
975	1,080	1,185	1,285	9.12.21
955	1,055	1,160	1,170	7.11.21
855	895	925	1,130	9.12.21
975	1,115	1,190	1,220	7.11.21
975	1,070	1,085	1,265	9.12.21
965	970	1,085	1,265	9.12.21
1,125	1,260	1,275	1,315	7.11.21
1,100	1,175	1,175	1,300	21.11.21
1,085	1,200	1,245	1,335	2.12.21
1,065	1,200	1,230	1,280	7.11.21
1,070	1,135	1,195	1,240	21.11.21
1,025	1,145	1,170	1,290	2.12.21
900	1,075	1,190	1,305	2.12.21
1,130	1,210	1,230	1,245	7.11.21
800	925	1,000	1,115	9.12.21
905	960	1,095	1,135	14.11.21
975	1,095	1,210	1,190	7.11.21
875	1,025	1,140	1,180	14.11.21
1,045	1,080	1,140	1,325	9.12.21
885	970	1,065	1,055	21.11.21
1,000	1,020	1,130	1,375	9.12.21
990	1,000	1,135	1,245	9.12.21

Original Weight on 10.7.21.	Weight on 29.8.21.	Weight on 24.10.21.	Final Weight.	Date of Final Weight.
Lbs.	Lbs.	Lbs.	Lbs.	
1,125	1,150	1,275	1,395	2.12.21
1,155	1,265	1,305	1,455	2.12.21
955	1,145	1,200	1,330	2.12.21
1,060	1,180	1,265	1,220	7.11.21
995	1,170	1,245	1,380	2.12.21
1,085	1,230	1,365	1,380	2.12.21
960	1,020	1,135	1,275	9.12.21
1,180	1,235	1,305	1,375	3.12.21
1,000	1,125	1,195	1,340	2.12.21
995	1,130	1,230	1,210	7.11.21
990	1,175	1,260	1,370	3.12.21
1,075	1,000	1,000	1,050	21.11.21
	(wild)			
1,100	1,200	1,310	1,405	2.12.21
1,040	1,145	1,245	1,345	2.12.21
1,000	1,025	1,120	1,250	21.11.21
900	1,025	1,140	1,195	21.11.21
1,200	1,440	1,525	1,620	2.12.21
1,065	1,075	1,140	1,225	9.12.21
990	1,065	1,120	1,165	21.11.21
1,000	990	1,120	1,110	21.11.21
1,040	1,095	1,225	1,220	7.11.21
1,200	1,345	1,475	1,480	2.12.21
990	1,000	1,080	1,150	14.11.21
950	1,035	1,180	1,255	9.12.21
980	1,150	1,275	1,400	3.12.21
940	1,085	1,110	1,220	14.11.21
975	1,120	1,200	1,305	3.12.21
1,180	1,250	1,375	1,430	7.11.21
1,045	1,070	1,185	1,240	3.12.21
1,120	1,240	1,315	1,340	7.11.21
900	1,020	1,110	1,220	3.12.21
1,080	1,250	1,380	1,415	7.11.21
1,100	1,135	1,180	1,310	3.12.21
1,100	1,085	1,150	1,275	9.12.21
<hr/>				
Tl. 59,100	64,600	71,170	74,235	
<hr/>				
Avg. 1,019	1,113	1,227	1,279	

It is the average figures in the last line of the above table which deserve special attention as a guide to what results may be expected from fattening cattle on these lines rather than the individual cases.

The amount of food consumed has been shown above in Table I. The cost of producing this or its value if sold would, if it could be precisely determined and added to the other charges, furnish either the exact cost of producing each pound of beef or the actual profit on the produce fed to the stock. Any one can from his own experience make

calculations accordingly. However correct for any one particular case these might be, they would not be generally applicable, and any actual figures given are likely to prove misleading. The yield of veld hay may be anything from one-half to one ton per acre, maize may yield from five to fifteen bags per acre, and so similarly with other crops. Crops vary from farm to farm, field to field and season to season. The profit may be made to appear great or little according to the basis chosen. Nothing, therefore, is to be gained by submitting a statement which must obviously be of contentious nature and of problematical accuracy.

No two farmers are likely to agree as to what the cost of production is, or what considerations are to be included in assessing the value of fodder crops on the farm. Some would say that crops which are virtually unsaleable, such as silage and velvet bean hay, have no value apart from the cattle, since if not consumed they would ultimately rot. Others would take, not a profitable price arbitrarily assumed, but the actual cost of production, and, in doing so, interest on working capital, rent and payment for the farmer's own time might or might not be taken into account. Finally, others might insist on recording a profit on the crops whether any were left for the cattle or not. It is difficult to estimate the value of a crop to the farmer by virtue of its effect on other crops in other years through a rotation, but that it is beneficial is beyond doubt, and over and above the food value of these crops it is to be recollected that many, especially legumes, possess a value as soil renovators as well.

The fact that of the crops grown part are sold off the farm and part fed to the stock, as in the case of maize stover, ground nut hay, straw crops and velvet bean hay, complicates matters still further. The price of produce and of beef fluctuate and do not even have the same relationship to each other from year to year, so that arithmetical calculations of one season cannot be taken as holding good for the next year. It may pay one farmer better to feed his maize, and another to sell it. One farmer may do better by converting crops into milk, another into meat, and a third by direct sale to consumers, and so on.

Whatever conclusion may be come to as to valuation of crops, a number of considerations remain which deserve attention, but cannot well be expressed in figures. The crops grown for feeding purposes are largely unsaleable in their crude form, but none the less their cultivation is desirable, even essential, in the interests of the farm. It is hardly fair, therefore, to assume profits from them and deduct this altogether before estimating profits on the cattle, without the assistance of which that profit could not be realised. Both food and beast are essential in order to make the farm as a whole pay, and to distribute charges and profits on any one of the inter-dependent sections of the business is economically unsound. For instance, a farm consists of arable land, veld, cattle, pigs, poultry, sheep and so on, and any one section alone is rarely self-supporting or separately profit-earning. Even the crops are inter-dependent. Too much stress must not be laid, therefore, on the profit derived from one particular branch. A very important and practical consideration is that the foodstuffs grown have been turned to profitable account without leaving the farm, without heavy charges for

transport, marketing, and time spent in seeking outlets, whilst many, such as silage, are not at all marketable without conversion. Sale of these crops, even where it could be done, as in the case of ground nuts or beans, would deprive the farm of their manurial value, whereby the fertility of the farm would be reduced instead of augmented, whereas by feeding cattle the manurial value of the feed is added to instead of removed from the farm.

Each bullock produced close on three tons of manure, actually 177 tons were obtained, and it is estimated that about one ton of litter per beast was used as bedding. The valuation of manure on a farm is also an open question, depending largely on the uses, to which it is directed, but whatever it is, it must be reckoned to the credit of the cattle, and at the conservative estimate of 7s. 6d. or 10s. per ton, adds materially to the profits.

The native labour involved in feeding such stock is but a small item. Seven boys under constant white supervision were actually employed, special care being necessary in these experimental pens, but half the number with much less attention would have sufficed in an ordinary case.

The 58 head ultimately sold realised £775 16s. 5d. gross, or £13 7s. 6d. per head, and their value before feeding commenced was estimated at £8. Railages from Rusape and to Salisbury and Gwelo, and commission on sales, absorbed £54 5s. 1d. This is, of course, a variable item, which will be different in every particular case.

As proving that the quality of the animals when fed was all that could be desired, it should be recorded that a pen of six selected but not specially treated animals sent to Messrs. Schiff and Jacobson's Christmas live stock sale at Gwelo took the first prize of £50. These animals had been fed on commercial lines as above described, and in no way differently from the others.

The following particulars in regard to these animals will be of interest:—

	Live weight of pen of six.	Average live weight.
	Lbs.	Lbs.
At commencement of feeding ..	6,030	1,005
At termination of feeding	8,055	1,342.5
Increase	2,025	336
At Gwelo stockyard	7,500	1,250
Increase	1,470	265

Three of these six oxen were sold to Messrs. Coles and McKenzie, of Gwelo, who reported that their joint fasted live weight was 3,760 lbs. and the net dead weight 2,266 lbs. or 60.3 per cent. They add:—"These oxen made three very fine good carcasses of beef, the meat fine grained and thick, with the fat well distributed, and in our opinion very good export beef." It should be noted that the head and body fat, as well as the tail, pluck and hide, are excluded from the dead weight. These assets are of value. Some time elapsed between sale and slaughter, and

a longer period still from despatch from the farm, during all of which time the animals were falling off in condition. The actual loss in weight on a journey of 210 miles was 555 lbs. on the six head, that is 92.5 lbs. per head, or 6.89 per cent. The other three oxen were bought by Mr. Ali Kosher, of Gwelo, who states that he had never seen better meat, but that there were indications of bruising in the trucks and a difficulty in bleeding the meat owing to the effects of the journey.

In connection with these experiments, acknowledgment is due for help at various stages from Mr. H. C. Michell and Mr. B. Woods of the Inyanga Estate, Mr. Mundy, and Mr. Hampton at the Government experiment farm, Gwebi. It will be realised that much painstaking attention to detail is necessary to arrive at the conclusions and average figures given here.

Rates for Maize and Maize Meal.

The railway administration announce, as from 1st May, 1922, a reduction in the rates charged for the carriage of maize and kaffin grain (not beans) and maize meal consigned to the Belgian Congo.

The reductions from the principal stations are as follows:—

	Old rate, per ton.	New rate, per ton.
Salisbury to Congo border	£7 10 4	£6 5 5
Gwelo to Congo border	6 9 5	5 4 6
Bulawayo to Congo border	5 7 1	4 12 2
Livingstone to Congo border	4 5 3	3 0 4
Mazabuka to Congo border	2 19 7	1 19 2
Lusaka to Congo border	2 12 11	1 11 9

A Short History of the Infective Diseases

AMONGST THE DOMESTIC ANIMALS OF SOUTHERN
RHODESIA SINCE THE OCCUPATION.

(Continued.)

By J. M. SINCLAIR, M.R.C.V.S., Chief Veterinary Surgeon.

BOVINE TUBERCULOSIS.

The first case of bovine tuberculosis recorded occurred in 1908 at Umtali, the animal affected being a heifer imported some time previously from the Cape Peninsula. All the animals in contact were tested with tuberculin with negative results. As a result of the discovery of this case it was decided to apply the tuberculin test to all animals imported from the south. After upwards of two years' application this process was discontinued, chiefly because of the impossibility of obtaining reliable temperature records in young heifers, the class of animal then being largely imported. The age limit then in force—importations being restricted to animals with not more than two broad teeth—was in itself a considerable protection, especially in the case of animals raised under ordinary farming conditions. The application of the test to overseas animals was continued and provision made for testing Colonial animals where considered necessary. In 1910 nine animals imported from overseas re-acted to the test and were destroyed: five of these belonged to one consignment of eight bulls, and the heavy loss entailed was the result of the failure to have the animals tested before being shipped from England.

Two cases were dealt with during the year 1913. The first was that of an aged cow purchased a short time previous to death on the Gwelo stock sale, and *post-mortem* examination revealed lesions of advanced tuberculosis. On enquiry it was found that this animal had been in the possession of the vendor for four years and the examination of his herd and the application of the tuberculin test failed to locate any other cases. The second case occurred in a herd of pure-bred cattle near Bulawayo, the animal affected being an overseas cow which had been on the farm for several years. *Post-mortem* examination showed marked lesions of tuberculosis. All in-contact animals were tested and two re-acted, *post-mortem* examination in each case showing lesions of the disease.

In 1916 an old cow in a small herd of cattle in Umtali district was destroyed as suspected of being tuberculous; *post-mortem* and microscopic examinations confirmed the diagnosis. The tuberculin test was applied to the in-contact animals and eight re-actors were destroyed. During 1918 one case was detected at the Bulawayo abattoirs and one in the Gwanda district, and in 1920 an aged Sussex bull, imported many years previously from England, was destroyed in a very advanced state of the disease.

In 1921 a heavy infection, shown by the large number of animals which re-acted to the tuberculin test, was found in a large herd of pure-bred Shorthorns in Matabeleland. As the re-actors included several very valuable imported animals, it was decided to segregate them in a large paddock without the housing accommodation and artificial feeding which they had always had, and to remove the calves immediately after birth and rear them on foster mothers. The original herd has been tested twice since then; several animals re-acted and were placed with the segregated lot. It has been rather a surprise to find how well these animals are doing under natural veld conditions without any artificial feeding or extra attention; they are one and all in tip-top condition, due, perhaps to some extent, to their not having to rear their calves.

Although most of the cases of tuberculosis recorded so far have been in pure-bred imported stock, it does exist to a slight extent amongst locally bred cattle of the native and more common types. Since 1916 over 60,000 head of cattle from Southern Rhodesia have been slaughtered at the Municipal Abattoirs, Johannesburg, where a very efficient system of meat inspection is carried out. Amongst these thirty-two cases of tuberculosis were discovered, and it is somewhat extraordinary that most of these cases were in native cattle and not in the better quality or higher grade animal.

From our experience so far of bovine tuberculosis in Southern Rhodesia, the following conclusions may be drawn:—(1) The disease occurs occasionally amongst ordinary farm and ranch cattle, reared under perfectly open and natural conditions, but that under such conditions the risk of infection spreading is negligible. (2) Under artificial conditions, such as housing and feeding, infection will spread rapidly, especially in pure-bred or graded animals.

CONTAGIOUS ABORTION IN CATTLE.

It has been officially recorded that contagious abortion was first discovered in Southern Rhodesia in 1914 amongst a large herd of cattle imported from Northern Rhodesia and then undergoing quarantine at Sipolilo. It would be more correct to say that by means of the agglutination test the disease was then definitely diagnosed for the first time. Previous to that time the existence of the specific infection had been suspected in several cases, but the means for making a positive diagnosis were not then available. In 1906 a large number of dairy cows on the Salisbury Commonage aborted, and all the circumstances pointed to the existence of contagious abortion. The next serious out-

break which attracted attention occurred on the farm Newton, in the Marandellas district, in 1909. Forty-five cows with calves at foot were purchased at Bulawayo in June, 1908, and the following January a bull, purchased from the owner of the cattle on Salisbury Commonage amongst which contagious abortion had been suspected in 1906, was placed with them. It is stated that abortions began shortly after the arrival of this bull, and within twelve months over thirty cases had occurred. Although contagious abortion was not definitely diagnosed in this case, there can be no doubt that it did exist, but whether it was introduced by the bull from Salisbury or was contracted from local infection it is not possible to say. If, however, the view now largely held that the bull is a minor factor in the dissemination of infection be correct, it is probable that the Newton outbreak was due to local infection previously existent.

In his annual report for 1914 the Government Veterinary Bacteriologist wrote as follows:—"In November, 1913, information was given that a herd of cattle, at that time in quarantine on the Zambesi, were suffering from contagious abortion, and, on the arrival of these animals at Sipolilo, blood was taken from certain suspicious cases and was tested at the laboratory, with the result that it was found that four animals gave a marked positive re-action to the agglutination test. The matter being of such importance, the greatest care was taken in the performance of the test, for which three distinct strains of contagious abortion culture were used, namely:—

- (1) strain from the Pathological Laboratory of the Royal Veterinary College, London;
- (2) strain from the Nairobi Laboratory, British East Africa;
- (3) strain from the Onderstepoorte Laboratory (South African strain).

It is of interest to note that the re-actions with each strain closely corresponded, indicating that the specific contagious abortion of those countries (namely, Great Britain, British East Africa, Union of South Africa and Rhodesia) is identical. Samples of the same blood were sent to Sir John McFadyean, of the Royal Veterinary College, London, who was able to confirm the diagnosis.

"About the same time cases of abortion occurred among the cattle on the farm Gatsi, Marandellas, and on the application of the test these were found to be due to the *B. abortus*. Recent investigations into this outbreak suggest that the disease originated some five years ago from an imported Devon bull, which was sold to a farmer in the Marandellas district, with the result that the disease became so prevalent in his herd that he was eventually compelled to sell his stock and farm. The dispersal of infected animals has led to the dissemination of the disease throughout the district, but at the present time the outbreaks are apparently of a less serious character than hitherto.

"From time to time during the last ten years cases of abortion have been reported to the Veterinary Department, and these cases have occurred at certain periods of the year, generally about the time of the burning of the veld; but as the agglutination test has only recently

been applied for the detection of this disease, positive proof of the specific nature of these outbreaks has not hitherto been possible. It has been suggested that in this country the disease assumes a mild form, but that this is not always so is shown by the disastrous results attending the purchase of the Devon bull previously referred to."

It is clear from this that although the northern cattle referred to brought contagious abortion with them, the disease did exist at that time in Southern Rhodesia and had probably done so for a considerable period. Indeed there is good reason to believe that it existed amongst native cattle long before the introduction of cattle from adjoining territories and overseas.

During the last few years contagious abortion has been found in practically every district in the territory and there is no doubt that the centres of infection known to the Department reflect in a very small degree its general prevalence.

Legislative measures for the control of infectious abortion are not likely to prove successful, chiefly because many infected animals do not abort, but are nevertheless capable of spreading infection and may remain infective through several successive pregnancies. It is evident, therefore, that every breeding animal in an infected herd is a potential reservoir of infection, and that quarantine, segregation or destruction of patent aborters would not prove satisfactory. In small herds all infected animals could be eliminated by the agglutination test; but even if such animals could be disposed of satisfactorily, the process, as a general measure, is not feasible. It is possible that with the further knowledge that must result from the investigations now being pursued in this and other countries some radical means of dealing with the disease may be evolved; meantime, we must rely on vaccination and ordinary prophylactic measures with the object of reducing the losses and the spread of infection.

THREE DAY SICKNESS: EPHEMERAL FEVER OF CATTLE.

This disease of cattle, also termed "stiff sickness," is so called because from the onset of the symptoms until complete recovery is generally a period of three days. It was first heard of from North-Western Rhodesia at the end of 1906, and in January, 1907, its presence near Bulawayo was recorded by Mr. C. R. Edmonds, Assistant Chief Veterinary Surgeon. Within a few weeks it was reported throughout the territory and as far south as Vryburg. Fortunately the reports which had been received about the disease prepared stock-owners for it, and, although it was most disconcerting to see half or more of a herd lying about unable to move, the situation assumed a different complexion in a few days when the animals got up and started feeding. The disease has appeared every year since the first invasion, generally during the rainy season, and although the mortality is trifling, probably not more than one per cent., there is generally some loss of flesh and milk, which in a good season is quickly recovered.

(To be continued.)

The Relative Areas of Geological Formations in Southern Rhodesia.

By H. B. MAUFE, Director, Geological Survey.

The completion of a provisional geological map of Southern Rhodesia allows an estimation to be made of the areas occupied by the different rock formations. The estimate is necessarily a very rough one, chiefly for two reasons. First, the boundaries of the geological formations in the outlying districts are very imperfectly known, and, secondly, in some areas which have not yet been surveyed the topographical basis of the map is founded only on rough sketches. In fact the total area of Southern Rhodesia is not known with accuracy. The most recent figure received from the Surveyor-General's office is in round figures 152,000 square miles.

Whilst it is not possible to state accurate figures, some idea of the relative areas occupied by the geological formations may be given, and seeing how closely the nature of the soil is connected with the underlying rock, these figures are not without interest to agriculturists. Stated as percentages of the total area of Southern Rhodesia, the figures for the distribution of the chief rock formations are:—

Granite	49.5
Karoo formation	15.3
Kalahari formation	11.2
Basement schists ("formation")	8.5
Lomagundi formation	5.7
Basalt and dolerite	5.1
Umkondo formation	2.7
The Great Dyke . . . . .	.8
Area not determined	1.2

Most people would probably have given a higher figure for the granite area, and certainly for the basement schists, the latter being the chief formation of the gold belts and generally known amongst farmers simply as "formation." On the other hand, the figures for the Karoo formation, which includes the coal measures, and for the Kalahari formation, best known as the heavy sand which bears the teak and mahogany forest, are probably higher than would have been expected.

It will be admitted that, generally speaking, the sub-soils of the Territory are residual earths whose characters are dependent on the

nature of the underlying rock formation, the mineral portion of the soils being composed of these residual earths mixed with a greater or less, but generally undeterminable, amount of rain-wash or earth washed down the slope by the rains, which may or may not be, but generally is not, derived from a different formation. The only important soil which does not come under the above definition is true alluvium deposited by rivers and streams. Alluvium is not shown on the geological map, and it is recognised that it occupies but a very small percentage of the whole surface.

The black vlei soils on account of their peculiar characteristics require special mention. They are found on every formation, with the probable exception of the Kalahari sand. They differ amongst themselves according to the formation on which they lie, but owing to the peculiar conditions under which they form, they differ markedly from the more normal soil of the formation. Whilst in many instances a black soil is evidently a residual soil, in others there is considerable admixture of rain-wash, and it almost seems possible for it to grade into an alluvium. However that may be, it is not possible to give any figure for the total area of black vlei soil in the country, or even to indicate the relative percentages on different formations. It is probable that the largest areas of black vlei (or black plateau) soil occur on the basalt, whilst large areas also occur on parts of the Karroo formation.

Leaving out of account the alluvial and black vlei soils, and turning to the items in the table, the Kalahari formation yields an eminently sandy soil. The soil on the granite is considered to be a sandy one, but there would appear to be considerable areas under which clay from the decomposition of felspar enters largely into the composition of the soil, forming loams and even clays. The Karroo formation, in the parts of it that are occupied, consists almost entirely of sandstone and yields a light sandy soil, but in sparsely populated parts the formation consists of an alternation of sandstones and clays, where of course loamy or clayey soils may be found on it. Both the Lomagundi and Umkondo formations also consist of an alternation of arenaceous (sandy) and argillaceous (clayey) rocks, and consequently the soils vary from sand or sandy loams to loamy clays and clays, but I think the sandy forms will be found to predominate. The largest area occupied by the Umkondo formation is in the Melsetter and Chipinga districts, the predominant rock being a quartzite and the predominant soil a light loamy sand. The red clay soil of the Melsetter district is derived from a dolerite, and should be grouped with the other red clay soils derived from basic igneous rocks. This dolerite is locally known as "ironstone," a misnomer which should not be perpetuated, since there is a correct popular name, "whinstone," for the rock in question.

The chocolate and red clay soils of the basement schists are very well known, and the red clay soil which forms in normal conditions from basalt and dolerite has already been mentioned. A red clay soil also forms on the Great Dyke, though here, just as on basalt and dolerite, flat low-lying areas are usually covered by black vlei soil. Both the red clay and the black vlei soil on the Great Dyke differ from the

corresponding soils on other basic igneous rock formations (the basement schists, basalt and dolerite) in that they may contain an excess of magnesia. It is for this reason that the Great Dyke is frequently referred to as the "magnesia belt."

Summing up then, we may say that 14.4 per cent. of the surface of Southern Rhodesia is occupied by rocks which normally give rise to a red clay soil, whilst 73.2 per cent. is occupied by rocks normally yielding soils which are predominantly sandy. The remaining 12.4 per cent. either has an eminently sandy soil or its nature is not known.

The Use of Pure Bred Sires for Dairy Herds.

* By T. HAMILTON, M.A., N.D.D., N.D.A., Dairy Expert.

In no way can a dairy herd be improved more than by the use of a pure bred sire from a recorded milk strain. The tendency to produce milk is transmitted more by the influence of the male on the female progeny than by any other means. Not only is it to be expected that the milk production will be increased, but with the continued use of pure bred sires the progeny become increasingly more true to type. This is well illustrated in the chart published with this article. Although unfortunately we cannot regard the laws of breeding as producing mathematically accurate results, yet we can regard them as having the approximate effect, which is shown in the charts.

In Chart No. I. we see a scrub cow crossed with pure bred bull. Assuming that the law of breeding is mathematically accurate and that different pedigree bulls are used in succeeding generations, we find the result of the second cross to be three-quarters bred, the next cross seven-eighths bred, the fourth cross fifteen-sixteenths bred, and the fifth cross thirty-one thirty-seconds bred, and so on.

On the other hand, with a half bred sire on a similar cow and the continued use of a grade sire, it is graphically shown (Chart No. II.)

that it takes more than five generations to achieve the same results as can be achieved in two generations by the use of a pure bred sire. The progeny of the first cross with a half bred sire on a scrub cow is only quarter bred, the next cross is three-eighths bred, and the result of the next cross only seven-sixteenths, and the fifth generation only fifteen thirty-seconds pure. Thus, as stated as a general principle on the chart, more can be accomplished in two generations by the use of pure bred bulls than can be accomplished by the use of grade bulls in five generations. This applies generally to bulls of all breeds, irrespective of milk or beef.

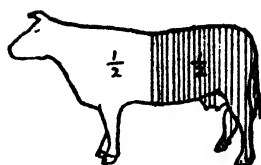
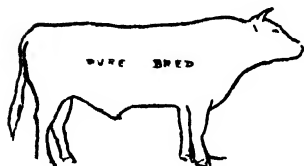
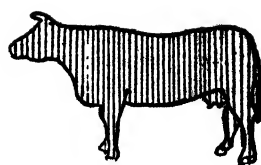
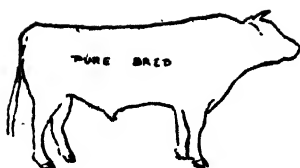
Milk Yielding Tendencies Transmitted.—The tendency of offspring to approximate to the physical characteristics of the stock from which they are bred is sufficiently self-evident. That the capacity to produce milk is also a hereditary tendency can only be proved by careful recording of the milk produced by the dam and of its offspring. When milk records were first introduced investigations were restricted to the yield of cows. It was proved that the character of high yields was hereditary. The next step forward was made when it was ascertained from the records of the milk recording societies that the capacity to yield large quantities of milk containing a high percentage of butter fat could also be passed on through the bull to his progeny. This is especially important, because it is frequently remarked that the bull is half the herd. It is obvious that it is in the bull's lifetime and in full vigour of breeding that it is of supreme importance to find out which bulls have a beneficial and which have an adverse influence in respect of yield of milk and butter fat.

For years before the inauguration of milk recording it had been customary in Denmark and in the United States to keep bulls in service for years, and bulls began to be judged more and more by the physical conformation of their offspring. This is undoubtedly the correct way to judge a bull, and it was the ability of that great bull "Admiral Beatty" to put the stamp of quality on his offspring which won for him world-wide fame and, incidentally, the sum of £7,750 for his lucky owner. Special prizes are offered at all the large shows all over the world for bulls and their progeny. For instance, in Denmark special shows for bulls and offsprings are held and special classes included, as follows:—

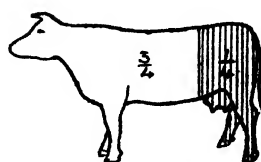
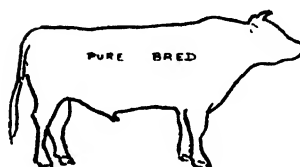
- (a) For bulls 5 years or older, domiciled for $2\frac{1}{2}$ years in a district. Ten descendants must be shown.
- (b) For bulls 6 years old, domiciled 3 years in a district, 12 descendants to be shown.
- (c) For bulls 7 years old, 4 years in a district, 14 descendants to be shown.

The recorded official milk yields of those females in milk and that of their dams must be stated in the entry forms.

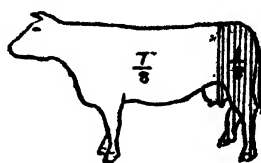
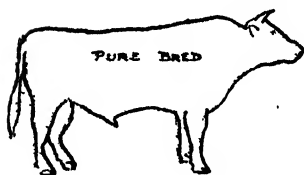
By the spread of the milk recording movement in dairying countries, this method of judging by means of the combination of performance and the progeny has had the effect of raising the standard of milk production to a very high level, as the following official records for various herds prove.



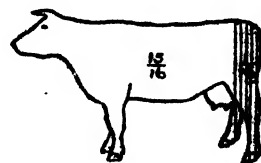
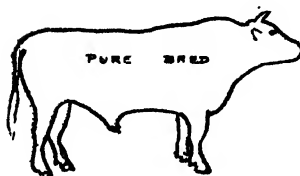
1st CROSS



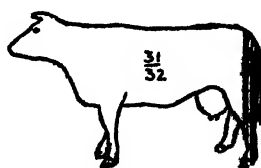
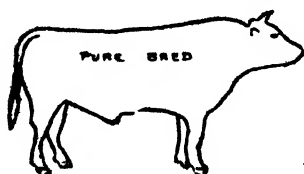
2nd CROSS



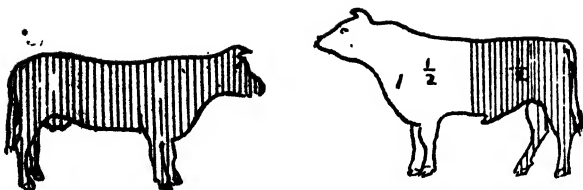
3rd CROSS



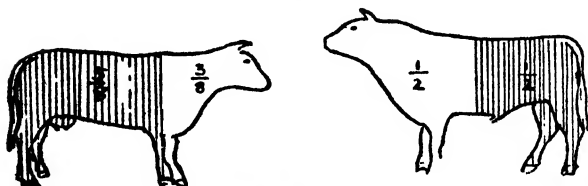
4th CROSS



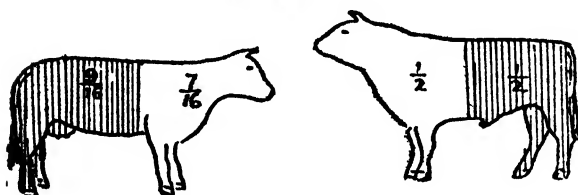
5th CROSS



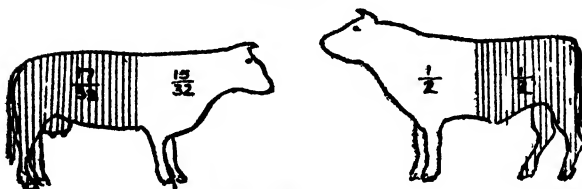
1st CROSS



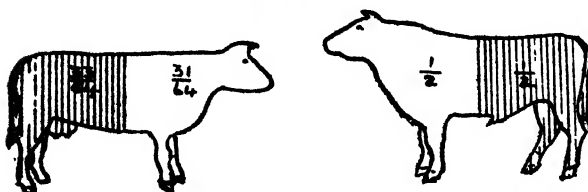
2nd CROSS



3rd CROSS



4th CROSS



5th CROSS

SHORTHORNS.

Year.	Lbs. milk per lactation.	Average percentage butter fat.
1903-04	6,349	3.30
1915-16	9,445	3.85
1901-02	6,864	3.62
1911-12	10,164	4.06

RED DANISH BREED.

Year.	Lbs. milk per lactation.	Average percentage butter fat.
1900-01	9,104	3.45
1914-15	10,336	4.19

Abundant evidence was forthcoming that certain bulls got daughters whose performance was better than their dams. On the other hand, it was also proved that other bulls had the opposite effect, *i.e.*, the performance of their daughters was not so good as that of their dams. Investigations in the United States, published by the Agricultural Station, Maine, U.S.A., give the records of progeny of bulls as well as the records of their dams. Only about half of these bulls in question produced daughters which gave a higher yield than the dams; the other half had the contrary effect. Two examples were given. One recorded sire of 34 daughters produced progeny whose yields on the average were 2,620 lbs. higher than their dams. A bull which from a milk production standpoint was unsatisfactory as a sire got nine daughters whose milk production was on an average 2,190 lbs. less than the average of their dams.

The value of such a system of recording, *i.e.*, registering the improvement of the progeny, would be lost unless breeders abandon the general practice of selling or slaughtering their bulls before the performance of their daughters can be ascertained. The following extract culled from an American article published in the *Natal Farmer* is of interest:—"A few years ago a Wisconsin farmer sold his registered Holstein bull to a local butcher. At the time the bull was sold no records had been made by any of the daughters. Within one year eleven of his daughters freshened at the ages of two and three. Records of milk and butter fat production were kept, and to the farmer's astonishment the average milk production was 15,047 lbs. and the average butter fat production 571 lbs. Long before these records were available the bull was dead and his hide converted into leather. Because there were no records a 5,000 dollar bull was sold for 50 dollars. The Cow Testing Association tests dams and daughters, the Bull Association makes it possible to keep a bull until his daughters are tested. These associations would have saved that bull.

"Every dairy herd should be carefully selected. Every carefully selected herd should be headed by a good bull. A good bull gets productive daughters. Such daughters greatly excel their dams. The dams may be selected scrubs, the daughters become productive grades, and the granddaughters high grades of very large production. A scrub

she yields no profit. A scrub he quickly drags the remainder of the year a scrub cow produced by a scrub bull, produced by the same scrub, produce as much.

Billy of Washington, the Lear Valley (Wis.) had been in the herd a while the butcher to prevent things looked bad for Just in the nick of the ages of two and son of the daughters The average production of butter fat. The he is now at the

can only be made The milk recording Rhodesia. Farming, business basis, and the cow enough to buy her feed Farmers who keep records are between those branches of Profit. Production is the basis of Production may possibly be the basis of produced at a loss or cannot are not in demand. Dairy production rests with the dairy farmer profit. This can only be done if keeping records of milk produc-

be Obtained.—It would be of Farmers isolated one from the other work individually to raise the country. The time soon arrives, when the pedigree bull at the head of the bull. It is there that diffi-

suggested that farmers should co- on the lines adopted in other farmer in this territory who cannot branching herd. If four or five her and obtain as many pedigree years' use in a herd, could be association. Eight to ten years' could be assured at a cost (to Each group or association would

make their own rules as regards guarantee of stabling, feed and treatment.

Should any one bull prove unsatisfactory as a sire, the association as a whole would replace him at small cost to each of its members. Useful pedigree bulls can now be obtained at a very reasonable cost, ranging from £30 to £70 per animal. The outlay is true to the advantages accruing from the adoption of such bulls are kept in the district until their value as sires should one or two of the bulls in the association prove to breeders, their use is retained as long as they show the same. Many breeders object for various reasons to keeping such bulls, but none of the objections usually advanced should be permitted to obscure the undoubted advantage that would result from the use of such bulls from bulls which, by the performance of their daughters, they are prepotent in milk qualities. This essentially is the reason by which the great breeders in the past, Bates and others, have maintained existing beef breeds of cattle. Its extension to the milk breeds of cattle presents no difficulties worth consideration if farmers would adopt the plan of forming bull associations as outlined in this article.

Beggar Weed and Kudzu

The following very interesting tribute to beggar weed, and velvet beans is to be found in an article in *Howard's Dairyman* by C. F. Leach, Cherokee farmer, Florida. It appears that Mr. Leach is a very successful dairying and stock-feeding farmer and that at the request of the editor of the above publication he describes the methods which in his opinion contribute greatly to his success.

The merits of kudzu vine were dealt with at considerable length in the *Rhodesia Agricultural Journal* for February, 1921. Since that date large numbers of rooted plants and packets of kudzu vine seed have been issued to farmers in all parts of the country with a view to hastening and popularising its introduction. Further experience has fully confirmed the high opinion formed of kudzu and its suitability to Rhodesia. It is a legume which will go far towards solving the great problem of

all-the-year succulent and nutritious grazing. It is deserving of being grown on every occupied farm and ranch in Rhodesia, and once its value is realised and proper attention is given to its propagation kudzu may well do for Rhodesia on a limited scale what lucerne has done for the Argentine.

The attention of farmers was called to the great promise of beggar weed as a substitute for lucerne on unirrigated land by an article on this crop published in *The Rhodesia Agricultural Journal* of October, 1921. Emphasis was laid on its free seeding habit, its ability to grow well on land which had received no special treatment and also on the prolificacy with which it seeded itself and volunteered on land adjacent to an established plot. All these virtues are confirmed by the following account on its behaviour in Florida.

The importance of velvet beans as an annual leguminous crop for yield of beans, hay, grazing and for soil renovation was very fully dealt with in the February issue of this journal, and the value of ground nuts as a grazing crop has been referred to at considerable length in both the last two issues.

If further evidence is needed of the manner in which these four crops can be successfully utilised in a sound system of mixed farming the following article should supply it.

"Our cows are on pasture nine months in the year. For seven months they have nothing but kudzu pastures, which easily carry over two head of cows per acre. The milk cows get no other feed and need none, for they keep fat and sleek and pretty on kudzu alone. The dry cows get a full feed of a well balanced grain ration for about forty days. This is to ensure good calves and a full flow of milk when they freshen. The cows go on to kudzu pasture on 1st April. The kudzu is then nearly two feet high. With only two head of stock per acre the kudzu never gets less than two feet high. It grows all summer and drought has no effect on it. The cows eat the young growth off the top.

"In October we turn the cows and the hogs into fields where we grow corn, velvet beans, peanuts and beggar weed in combination. We could keep them on the kudzu two weeks to two months longer, but if we did the velvet bean vines would have shed their leaves, the peanut vines would have dried up, and the beggar weed withered away to bare stalks. Therefore we take the cows off the kudzu and let it grow. Then we cut a good crop of hay before frost where the cows have pastured all summer.

"So we turn all the stock, the dairy cows, the Angus beef cattle and the hogs, into the fields where we have planted corn and peanuts in alternate rows and velvet beans two feet apart in the corn rows. The beggar weed volunteers after the last cultivation. Before turning in the cattle we husk out half the corn. I don't know how closely this combination of corn, velvet beans, peanuts and beggar weed approximates a perfect balanced ration, but I do know that the cattle and hogs get fat and sassy and have that jaunty and satisfied air of the perfectly thrifty animal. The cows pick up on their milk, the beef

stock are soon ready for the butcher, and the hogs make fine, hard pork, with a flavour that nothing in all the world can produce but peanuts.

"In winter the dry cows are fed a well-balanced ration in a section by themselves until about two weeks before calving, when they are transferred to a separate lot at some distance and fed kudzu hay and a little oil meal.

"The milk cows each get 5 lbs. of velvet beans in the pod in the morning and 5 lbs. of corn at night. All the cattle get 20 lbs. of kudzu hay at night. That sounds like a lot of hay, but it is only the roughage they get, except the winter pastures.

"The object of these winter pastures is to provide succulence only, as our cheapest and most nutritious roughage is kudzu hay.

"The main idea about our system of dairy farming and stock feeding that differs from the methods practised by most farmers and almost universally recommended by experts and writers for the agricultural press lies in our larger use of leguminous forage and smaller use of purchased grains and concentrates. When you can secure five or six tons of hay per acre from a perennial forage plant like kudzu that never has to be replanted and needs no lime or fertiliser, and after the first year no cultivation, you have got pasture and hay so cheap that it seems incredible. When velvet beans will make from one to two thousand pounds of grain, containing 18 per cent. protein, right in your corn without diminishing the yield of corn, it is folly not to plant them.

"Beggar weed costs nothing at all, for it will soon fill the soil so full of seed that it will volunteer every time you stir up the earth and so makes a crop of the finest forage in sixty days after you lay by your corn or other tilled crops. As a forage it is as much superior to Hubam clover as Hubam is to the old biennial sweet clover. Beggar weed will grow on very poor sandy soil that will not produce fifteen bushels of corn per acre. It requires no lime and no fertiliser, and being a legume with a large and deeply penetrating tap root, it adds as much nitrogen and humus to the soil as any of the sweet clovers, and yet two-thirds of the farmers in the cotton belt have never seen beggar weed and very little has been done to extend the area of its culture. The seed, which is produced in such riotous profusion, is scarce and hard to obtain because no effort is made to save it. Every acre of our farm is well seeded down to this splendid forage plant and furnishes our stock with a world of feed that costs absolutely nothing and at the same time enriches the soil, while we produce milk and meat at a price that will seem impossible to the live stock raisers of the north."



Volunteer Beggar Weed.—In 1919 this plot carried kikuyu grass, which, as the growth was weak, was dug in during 1920. Beggar weed volunteered strongly, but was not permitted to seed. In January, 1922, the plot was trenched 2 ft. deep, and kikuyu was again planted. This photograph, which was taken last April, shows the beggar weed again volunteering strongly, and making more growth than the kikuyu

Improvement of Rhodesian White Maize by Selection.

By C. MAINWARING, Agriculturist.

The maize varieties grown in Rhodesia have undergone a marked improvement since their introduction. They now differ greatly from their original forms, whose type and characters were at first most variable. Under the influence of climate, soil, cultivation and the continuous careful selection to which the plants and grain have been subjected, our standard varieties have been greatly improved. The "White Flat" maize we are producing to-day is considered by competent authorities to be equal if not superior to that grown in any other part of the world. Some ten years ago several breeds of both yellows and whites were being grown, and, as very often was the case, a mixture of the two. Since maize is the staple crop of Rhodesia, the average and production increased rapidly, and it was soon evident that if we wished to produce only grains of the very finest quality the attempt to grow both whites and yellows must be abandoned.

The maize plant cross-fertilises readily; it is in fact dependent on cross-fertilisation from neighbouring plants. A mixed sample of part-coloured grain lowers the grade, and it is neither profitable nor desirable to export mixed grades. It was therefore agreed between the Agricultural Department and the maize growers of the country that the continuation of growing the two kinds was impossible, and that one would have to be eliminated. Accordingly yellow varieties were discarded and whites were given the preference, for the following reasons:—(1) There was and is no local demand for yellows (the yearly local consumption of whites is 600,000 bags); (2) the export price on the European markets is the same or nearly so for "Flat Whites" or "Flat Yellows."

Now, although to-day the country is free from any admixture of colour and continuous and careful selection has been carried on year after year, with practically only the two acknowledged varieties grown—Hickory King and Salisbury White—still, upon examination of a growing maize crop it will be noticed that the plants are far from being uniform; some show more vigour, producing suckers freely; some plants are barren, while others bear two ears, even though all have had the same growing space and treatment. These differences are easily seen and well known.

While the maize plant grown from well-bred seed reproduces its main characters unchanged, still they are not absolutely fixed and stable, but are variable in minor degrees. Every plant grown from seed, however well-bred, has inherited characters to a varying extent from each of its ancestors for an indefinite number of generations, and is also more or less influenced by climate and other conditions affecting the development of the plant. Generally the influence of the immediate parent is the dominating one, but not infrequently a characteristic of an ancestor which has been transmitted *unexpressed* for generations may appear in such strength as to change the character of the plant in growth, type or colour of grain. In view of these conditions, a rigid adherence is necessary to that ideal which is laid down for the variety as a standard to aim at in selection from year to year, never varying or giving way to the ever-present temptation to select superlative individuals which differ in any single respect from the agreed ideal of the breed.

On account of the maize ear being so large as compared with the ears of other cereals, the ease in handling it, the large number of grains it contains, and the small number of ears required to plant a given area, in addition to the easily visible different characters in the plant and grain, it is not surprising that the ear of the maize has been studied closely with regard to type and characteristics and their possible relation to yield.

Various systems of maize selection (often wrongly termed breeding) have been proposed, each possessing its advantages and disadvantages. The possibilities for variation in procedure at many points are so numerous as to make it seem useless to attempt to lay down explicit directions to be followed absolutely in all details. The conclusion, however, has been arrived at that there are certain fundamental characters which are apparently associated with yield, and which are therefore set up as an ideal to strive for in selection. This being so, the following outline is offered as a general guide, it being understood that many details must be left to the judgment of the grower to be carried out as conditions and circumstances may determine.

Ear to Row Test.—This is generally advocated by most writers on this subject, and offers the greatest possibilities for improvement if properly carried out (it appears simple on paper), but success depends absolutely upon the accuracy with which the numerous details of the work are conducted. The system is recommended only for the grower or breeder who can give the requisite time and the careful attention demanded.

Mass Selection.—The system generally practised by the Rhodesian maize grower is what is known as "mass selection." This method is much the simpler, and is recommended for the busy farmer who is not able to spare the time or give the attention required by the more exacting system of the ear to row test. In Rhodesia we are fortunate in possessing men who have gone to the trouble of producing high yielding strains of our standard varieties. They have through years of careful selection eliminated the poorer individuals, and have pro-

duced strains whose yielding power and quality for generations are known.

For the settler who intends to grow maize, it is recommended that he should purchase sufficient well-bred seed from the nearest well-known grower in his locality, and with this plant a seed plot. This will give him a good start, and save a vast amount of work and trouble incurred by the unsatisfactory method of buying ordinary cheap seed, and from this breeding up a fixed strain. The seed plot should be amply large to permit of the required amount of seed being selected without necessitating the choosing of any but ears of the best quality. This means that the plot should be large enough to produce many times as much seed as is actually wanted for planting purposes, for however well-bred the seed is, not one ear in a dozen will possess all the good characters required. Seed maize for all home requirements should if possible be selected from this plot.

Field Selection.—The most important advantage of field selection is that one can see which are those plants that have produced a large ear or one of the normal size under average conditions. One does not know when selecting ears from the harvested heap that those chosen have not had some particular advantage during growth, such as extra space or more favourable soil conditions. Large ears produced under good conditions have not been found to constitute a better yield than ears of moderate size produced under normal or even adverse conditions in the field. Therefore, in order to obtain the best results, the stalk which bore the ear should be studied as well as the ear itself. This does not mean, however, that great improvement cannot be made from the study of the ear only, but it is a fact nevertheless that a better selection can be made in the field just before the general reaping, when the opportunity is afforded of noting the nature of the parent plant as well as that of the offspring ear.

In the selection of ears for seed, great attention should be given to the following points:—Trueness to type, uniformity of appearance, size, shape of the ears, and character of the indentation of the grain. Greater uniformity in these characters means more uniformity in flowering, which has been found to be directly associated with a smaller percentage of barren stalks. With regard to other visible characters of seed ears, the most important is probably the weight. Since from 80 to 90 per cent. of the total weight of the ear consists of grain, it is important to select those ears which are heavy when dry, especially in proportion to their size. Practical farmers do not go to the trouble to weigh their seed ears on scales to get the exact weight, since after a little practice it is found easy to select the heavy ears by rough estimation of the weight in the hand. One who keeps this in mind will find many good ears of size and appearance on the harvested maize dump which have been missed or overlooked when selection took place among the plants in the field. The outside appearance of the ear when still covered by the sheath is sometimes deceptive, but the rough estimation of the weight may be ascertained by practice, and this will be found to be a very reliable guide in selecting ears with good solid weighty grain. An ear of cylindrical shape is also more

desirable than one which tapers rapidly from butt to tip, as the latter not only shells less grain, but also contains grains which on approaching the tip become gradually narrower and shallower, so that a large amount must be discarded from the ear to obtain grain of uniform regular size for planting when the ears are used for seed.

Having once obtained a good strain, careful yearly selection will be necessary, for deterioration will constantly take place if this selection is not persisted in. The day when growers could afford to plant any sort of seed has passed, and no intelligent method of farm management disregards the production and use of good seed.

Salisbury White Maize.—A white variety largely grown in Rhodesia is the result of a hybrid which was originated in the Salisbury district. During recent years it has been greatly improved and more or less fixed in type until it has reached a high degree of productivity. This variety is also finding favour in the Union. It has twelve rows, and is a tall, vigorous grower, with good, leafy foliage. The full benefit of growing Salisbury White will not be maintained if the seed is not kept reasonably pure and a uniform type aimed at. If the ears are not continually and carefully selected, much of the advantage of growing this variety will be lost. This will be especially true for those who expect to grow it for seed or exhibition. It matures in 145 to 150 days, according to the season, and is considered a better cropper on rich land than Hickory King.

The characteristics of Salisbury White are:—The ears vary from 9 ins. to $9\frac{1}{2}$ ins. in length and 7 ins. to $7\frac{1}{2}$ ins. in circumference; partly cylindrical, with slowly tapering tips. The butts are moderately well rounded, and the tips are generally well covered. The spacing of the rows is narrow, and the kernels are medium to broad in width and wedge-shaped. The colour of the grain is pearl white, bearing good germs of strong vitality. The indentation is a pinched dent, giving the grain a slight roughness. This roughness, if *too accentuated*, leads to extreme "chaffiness," and should therefore be avoided. Average weight per bushel, 58 lbs.

Hickory King is the best known and most popular variety grown in Rhodesia. It was introduced into Natal from America, and from there came to Rhodesia. Characteristics:—Rows, eight; length of ear, 9 ins. to $9\frac{1}{2}$ ins.; circumference, 6 ins. to $6\frac{1}{2}$ ins.; partly cylindrical tip, regular rows of grain, butt even. The grain is large and attractive in appearance. Indentations, smooth to slightly rough; size and shape of ear and indentation of grain have been strongly fixed by careful intelligent selection, and are uniformly reproduced. It is considered that the Rhodesian strain of Hickory King is one of the most improved breeds of maize known.

Louisiana or 10-row Hickory is a type developed from Hickory King by the continued selection of the 10-row ears. The late Mr. G. Duthie grew this type with great success. Characteristics:—Ear, cylindrical; length, $8\frac{1}{2}$ ins.; circumference, $6\frac{1}{2}$ ins. to 7 ins.; space between the rows narrow; grain ivory white in colour; roughish indentations; shape, broad wedge; considered more drought-resistant than Hickory King.



MAIZE IN MATABELELAND

The above illustration shows a remarkably fine crop of maize grown this season on Mr F. D. Walker's farm Alsley, near Bulawayo, with a rainfall of less than 12 inches. At the date this photograph was taken there had been no rain for several weeks, and though, as can be seen, the plants were of excellent height and vigour, their ultimate yield of grain was dependent upon further rain. The land was beautifully worked and entirely free of weeds. The crop serves to illustrate how, if the land is properly worked, maize can be grown even in a season of phenomenally light rainfall.

The Common Sunflower.

(*HELIANTHUS ANNUUS.*)

By C. MAINWARING, Agriculturist.

(*Bulletin No. 181 revised and brought up to date.*)

The sunflower is an annual plant, attaining a height of 4 to 10 ft. under ordinary cultivation and bearing large, flat, circular flower-heads. The seed is the most useful portion of the plant. In Rhodesia the seeds are at present chiefly employed in the feeding of poultry, but are also used to some extent mixed with other fodder, as a cattle food or for the extraction of oil. The leaves and the stalk have distinct food values, and when reduced to a sufficient state of fineness possess nutritive qualities of a high order. The stem contains strong bast fibres, and the plant has often been suggested as a source of cellulose for paper mills. The fibre is too weak and brittle to be of value for textile purposes.

The sunflower cannot be regarded as a major or staple crop in Rhodesia, but is a useful accessory in mixed farming, and its cultivation could with advantage be extended on a much larger scale, especially in districts of light rainfall, since its drought resisting qualities are assured. During recent years there has been no important increase in the acreage until last season, 1921, when the acreage nearly doubled itself, though the yield per acre was not as good as in 1920.

RHODESIAN ACREAGE AND YIELD PER ACRE FOR FIVE YEARS, 1917-21.

Year.	Acres under cultivation.	Total yield (bag of 103 lbs.)	Average yield p.a. (bag of 103 lbs.)
1917	1,018	3,310	3.2
1918	717	1,543	2.1
1919	1,041	2,938	2.8
1920	1,826	12,320	6.7
1921	3,974	23,204	5.8

Chemical Composition.—The following table gives the Rhodesian and American composition of the various parts of the sunflower plant for feeding purposes.

Analysis of sunflower leaves:—

	Sample as taken (Rhodesian). Per cent.	Air-dried (Rhodesian). Per cent.	Air-dried (American). Per cent.
Water	78.73	14.87	12.51
Ether Extract (fat) ...	.70	2.82	4.09
Protein	4.12	16.50	10.15
Carbohydrates	10.53	42.15	38.83
Crude Fibre	1.97	7.87	13.16
Ash	3.95	15.79	21.26

It will be observed that the above sample of Rhodesian grown sunflower leaves was over 62 per cent. richer in protein and 47 per cent. lower in crude fibre and 31 per cent. lower in ether extract (fat) than the American grown product.

Analysis of sunflower heads after the removal of the seeds:—

	Rhodesian. Per cent.	American. Per cent.
Water	11.73	7.40
Ether Extract (fat) ...	3.18	5.07
Protein	8.86	9.91
Carbohydrates	46.42	39.79
Crude Fibre	18.19	18.44
Ash	11.62	19.39

Varieties.—There are three principal varieties of sunflower in cultivation known by the colour, shape and size of the seeds—one with large white seeds, one which gives the heaviest weight per bushel, with small black seeds, and an intermediate form with striped seeds. The small black seeded variety is the general favourite and is the most largely cultivated in Rhodesia.

Climate and Soil.—The sunflower is a dry land crop and is more resistant to heat and drought and is often more profitable on poor soil than maize. It is therefore adapted to those portions of the territory where, owing to uncertain rainfall or poverty of soil, maize is an unreliable crop. The ability of sunflower to grow better than maize where conditions are not favourable is probably due to several characteristics, some of which may be that the plant is furnished with a much longer and stronger tap root and that it has a more vigorous fibrous root system, which probably increases the ability of the plants to absorb moisture from the dry soil. Sunflowers frequently flourish during periods of drought which will check maize past recovery. After germinating, the plants at first grow more slowly than maize and use the moisture stored in the soil less rapidly, thereby leaving more of it for later use. On the other hand, the slow growth following germination renders the sunflower less productive and valuable than maize, when the rainfall is ample and the soil fertile. Where the first consideration is to produce a crop either for cash or feeding purposes, maize is considered more profitable than sunflower, even when the latter gives slightly higher yields, for the reason that sunflower seed is usually at a discount on the market as compared with maize. It is also considered that it costs more

to produce an acre of sunflower than an acre of maize, which is important where the yields are nearly the same. In our most fertile districts the soil and climate are well adapted to maize, but in drier portions of the territory sunflowers are more likely to flourish and to prove profitable.

Manuring.—Except on good fertile soils or soils well supplied with humus the best fertiliser for sunflower is well rotted farmyard manure, or a crop of velvet beans ploughed under the previous year. When manure is applied directly or in large quantities the plant usually produces sappy wood and a number of lateral branches which adversely affect the quality of the seed. The manure is usually applied, therefore, to the preceding crop, and in sufficient quantity to leave the land well prepared for the sunflower.

In view of the fact that the sunflower crop takes so much mineral plant food out of the soil, it is sound practice to collect and burn the stalks and other refuse and return the ash to the land on which the crop was grown. The following is the analysis of Rhodesian sunflower ash, prepared from a sample of stalks, leaves and heads after removal of the seed, made by the chemical division of the Department:—

Sunflower ash:—

Analysis.	Phosphoric Oxide	0.98 per cent.
	Potash	28.90 per cent.
	Lime	12.00 per cent.

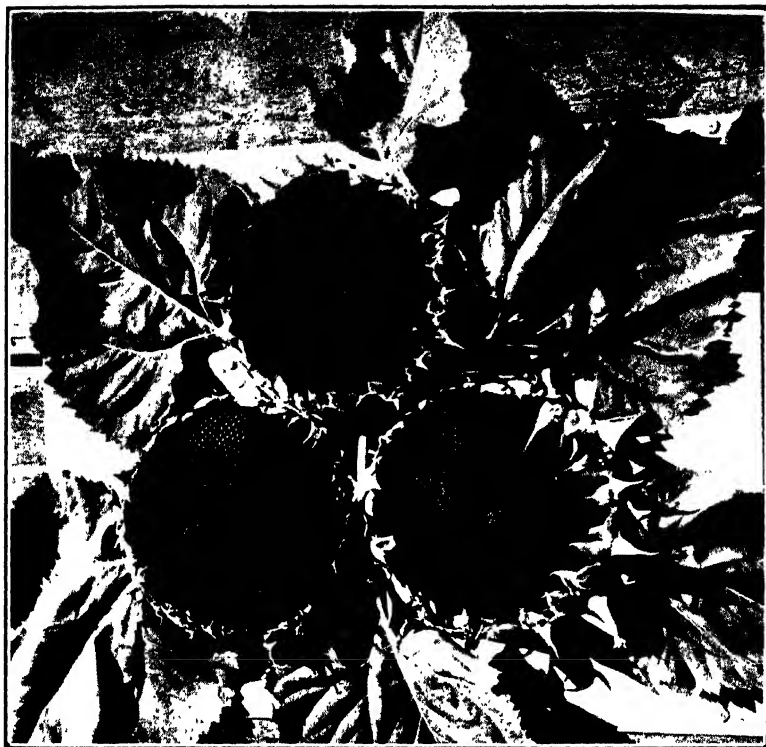
Preparation of the Land.—Since sunflowers will grow better than most crops with poor methods of cultivation, it is often the most neglected crop on the farm. However, good methods usually pay, as well with this, as with any other crop. The preparation of the ground for sunflower varies with soil, the preceding crop, the rainfall and the seasonal conditions. On most soils autumn or early winter ploughing gives the best results. Early ploughed land is more thoroughly weathered during the winter. This puts the soil in better condition and more plant food is liberated. If it is necessary to delay ploughing until the first rains, it should be done as soon as the conditions of the ground will admit. The right depth of ploughing varies with the nature of the soil and the time that the work is done. Deep autumn ploughing (8 to 9 ins.) is advisable on nearly all good land. On thirt soil, especially where the top layer has been washed off, deep ploughing may not be advisable. In many cases it may even be injurious. Where the ground has not previously been ploughed to a depth of 5 to 6 ins., it is best to increase the depth gradually. This is especially true in areas of heavy rainfall and with heavy soils. If under these conditions a considerable amount of unweathered sour soil is turned up, the yield is likely to be reduced for one or more seasons. Early spring discing of autumn ploughed ground is often desirable to kill weeds. The ground should be disced or drag-harrowed sufficiently to keep the weeds under control, especially just before planting. Weeds then growing will not get ahead of the sunflower and will not be too large to be easily killed by the time the crop is high enough to cultivate. The land ploughed after the rains should be disced for the same reasons and to put it in proper condition for planting.

Planting.—Sunflower for seed or silage is always planted in drills, the rows being 3 ft. apart and the plants 12 to 18 ins. in the row. The time to plant varies with the season and the locality. As a rule the best time to plant is the same as suits the maize crop. The sunflower is a sun-loving, hot weather plant, and makes its maximum growth during the summer months. It is good practice to plant so that the crop will be in the right stage for harvesting after the rains and before the first frosts.

Rate of Planting.—It is rarely difficult to obtain a good stand of sunflower. The general tendency is to plant much too thickly. Thick planting ensures a good stand, but if the conditions are favourable for germination and the thinning out of the surplus plants is neglected, the early growth is weak and spindly, and from this the plants never properly recover. When grown for seed, sowing is at the rate of 8 to 10 lbs. per acre, and when the plants are 6 to 8 ins. high they should be thinned out to a distance of 12 to 18 ins. apart in the row. Where grown for silage, thinning out is rarely required. Sunflower seedlings are not quite as vigorous as those of maize; the seeds, therefore, should usually not be planted as deep. It should be planted in moist soil if possible and covered deep enough to prevent drying out. As a rule 1 to 2 ins. is about the right depth. On wet heavy soils 1 in. is usually sufficient, while on light sandy soils 2 ins. and possibly more is necessary for the best results.

Cultivation of the Crop.—The cultivation should be the same as for maize, the principal purpose being to kill the weeds and keep the soil aerated. Before the thinning out stage of growth is reached a light spike-toothed harrow can often be used to advantage; after that an ordinary maize cultivator may be used. The proper depth of cultivation depends on the time when the work is done; usually 2 to 3 ins. deep is best. While the plants are small and before the roots occupy the space between the rows, the ground may be stirred deeply with good results. After the roots spread across the rows the soil should not be stirred to a depth of more than 3 ins., preferably less. Practically all tests show that deep cultivation at this time does more harm than good. If the ground becomes crusted with heavy rains, cultivation to break this crust is advisable; otherwise considerable moisture may be lost by the run-off or through evaporation. More cultivation than is necessary to kill the weeds and keep the surface soil in condition to absorb moisture usually does not pay. Many weeds may be killed by good preparation of the land and by disking and harrowing before planting. Rotation of crops also reduces damage from weeds. Proper attention to these matters will greatly reduce the amount of cultivation necessary.

Harvesting.—The sunflower takes four to five months to mature, according to the season and soil. The seed heads should be harvested shortly before they are thoroughly ripe, when the seed is firm and set. The heads are cut off by hand, and for this purpose a sickle or light, short cane knife can be used. They are generally left on the land face upwards for a few days to dry. One native can reap roughly about half an acre per day, including, after removal of the heads, the cutting down of the stalk to ground level. Every effort must be made to prevent mould or



Small black-seeded sunflowers grown with 10.78 inches of rain at the Salisbury Experiment Station, 1921-22



Striped-seed sunflowers grown with 6.37 inches of rain at the Salisbury Experiment Station, 1921-22.

fermentation whilst the heads are drying, but as the crop is generally reaped after the rains have ceased this does not usually present any serious difficulty. When the heads are dry they should be bagged and carted, and should then be piled face downwards on a hard floor and the seed beaten out with sticks. The seed is spread out thinly and shovelled over occasionally and allowed to become perfectly dry before bagging.

Selection of Seed.—The use of pure seed of good quality for planting purposes is as important in sunflower as it is for maize, and as one bag of seed will plant 8 to 10 acres, the expense is very small. Sunflower cross-fertilises readily; this almost always results in deterioration. Very little of the sunflower seed produced in Rhodesia is pure, and most of it is mixed sufficiently to reduce its value for seed and for market. This mixture is largely due to growing the two varieties—striped and black—in the same neighbourhood, and to careless methods of selecting and handling. If more than one variety is grown for seed, they should be separated by at least 500 yards. Even then bees and other insects that visit the heads at flowering time may cause a little cross-fertilisation. Hybrids, though often desirable as individuals, are always objectionable because their seed fails to produce plants true to type. Hybrids should be removed each season. The right time to select is just before harvest. This method, however, is practicable only for small quantities of seed for home use. There are several advantages of selecting heads in this way. The grower has an opportunity to note the stalk characters as well as the head. Heads somewhat above the average size should be selected, but no advantage is gained by selecting heads that owe their size to a thin stand or extra fertile soil. Hybrids should always be avoided, even though they are large and appear better than others, as is frequently the case. Plants that branch freely and heads that shatter freely should be avoided. Selection of heads should be made from sturdy, upright stalks, without lateral branches and with a maximum number of leaves.

Yield.—The yield of sunflower seed varies according to the fertility of the soil, variety and the methods of planting and cultivation. In Rhodesia, under normal conditions, yields of 12 to 14 bags per acre (a bag weighing about 100 lbs.) should be regarded as an average crop. though yields of 25 to 30 bags are produced under exceptionally favourable conditions. Experiments are being carried out both on the Salisbury experiment station and also on the Gwebi experiment farm to further test cropping capacity.

Sunflower in Rotation.—Sunflower is generally in other countries thought to be an exhausting crop, but this has not been found to be so in Rhodesia, and indeed the opposite is the general view. A sunflower and maize rotation is being conducted at the Salisbury experiment station to ascertain whether, as is frequently reported, the sunflower is really a useful change crop with maize. One plot grows maize every year and two other plots are annually rotated with maize and sunflower alternately. For the three previous years all three plots had received similar treatment. The test commenced in 1920-21, and for the first season the yields were:—

Maize after maize 23 bags per acre.
 Maize alternating with sunflower ... 22½ bags per acre.

If this trial as yet does nothing else, it at least seems to indicate that in Rhodesia the sunflower is not an exhausting crop.

The sunflower is comparatively free from diseases and insect enemies, while mice and rats are the only enemies that seriously damage the seed.

Sunflower for Silage.—Many conflicting reports are received from different sources regarding the use and value of sunflowers for silage. Its value seems to depend a great deal on the stage of growth at which it is cut and the care taken in making the silage. If cut when the stems are hard and pithy it is unsuitable for the purpose, owing to its indigestibility. Few experiments in making sunflower silage have yet been carried out in Rhodesia, but these have been commenced this year on the Salisbury experiment station. In this connection the following extracts from an article written for the *Agricultural Gazette* of Canada, by Professor G. H. Hutton, Superintendent of Agricultural and Animal Industry, Canadian Pacific Railway, may prove of interest: "The developments of the last three years have brought the sunflower to the front as one of the most satisfactory crops that can be grown for silage purposes. It has been proved by experiments and extensive private feeding trials that the sunflower yields well, the silage is palatable, and is at least equal, if not superior pound by pound, to corn (maize) silage. Many comparisons made between corn (maize) silage of the best quality and sunflower silage have shown the balance of economy of gain in beef cattle and yield of milk in dairy cattle in favour of the sunflower." On the other hand, a contributor to *Hoard's Dairyman* (Wisconsin, 3rd March, 1922) is not satisfied with sunflower silage, and writes as follows:—"Here, on Puget Sound, corn (maize) does not mature early enough for silage, so when we heard of the success being obtained throughout the country with sunflowers, and knowing they would grow here, we decided to plant 3½ acres. The yield was heavy, about 20 tons to the acre. It was planted in rows 3 ft. apart and cultivated as corn (maize). They were planted the 10th May, which was as early as the ground could be worked, and harvested about the middle of September, when they were about 60 per cent. in bloom. They could not be left any longer as the frost had turned some of the leaves black. We are now feeding the silage. It is very sour and next to impossible to get any of the stock to eat it. Our country agent says he is sure that it is from excessive moisture due to the crop not being properly matured. This seems reasonable, for the juice from the sunflowers runs down the blower in a stream. For next year I am sure we will plant oats or wheat mixed with vetch, which gives a fair yield and good quality silage."

The above extracts show that opinions differ as to the value of sunflower silage and that the matter is still an open question. No experimental data on this point are yet available for Rhodesia, but where maize can be grown to better advantage than sunflower, it is the logical crop to use, as it has been proved by stockmen to give satisfactory results.

Uses of the Seeds.—The seeds are the most valuable part of the plant on account of their edible kernels and of the superior quality of the oil prepared from them. In Russia they are used largely for human consumption, where they are eaten in the same way as ground nuts or monkey nuts in other parts of the world. Birds of all kinds thrive upon the seeds and they are specially employed in fattening fowls for table, while a sunflower diet is said to increase the laying powers of poultry. In Rhodesia the seeds are at present employed in feeding poultry and to some extent mixed with other grains as a cattle food. In Salisbury there is some demand for the seed by the Farmers' Co-operative Oil Factory and also by the Mark Harris Manufacturing Co., but the local manufacture of oil up to the present is comparatively small. The industry may, however, increase and become important. The oil obtained by expression is a most valuable product for many purposes. In its pure state, it is said, on account of its palatability and sweetness, to be excellent for table use, for frying fish, and for other culinary purposes. It may also be used for woollen dressing, lighting and varnish and soap making. For the last mentioned purpose it is said to be superior to most oils. The question of whether the crop will pay to grow on a large scale or not must depend, however, on the export prices obtainable and the local demand.

Citrus Fruit Growing in Rhodesia.

(Concluded.)

By A. G. TURNER, Citrus Adviser.

Irrigation.—No excuse need be offered for repeating that no citrus orchard should be laid out in Rhodesia without there being facilities for irrigation, especially in view of the fact that some planters and intending planters in this Territory are under the impression that irrigation for citrus orchards is not essential. The rainfall of Rhodesia cannot be relied on for even distribution, hence the necessity for applying artificial water during long dry spells that not infrequently occur at periods from October to March; again, when rains are late in setting in, it is necessary to continue irrigation, while in some years the rains continue until April, in which case, provided the land is thoroughly worked up, it is not necessary or advisable to irrigate early navels prior to picking.

It may safely be said that no definite period is the right one in Rhodesia for irrigating oranges. In one year it may be necessary to commence irrigation of trees in April, on account of early cessation of rains, and continue right through to November and even December if rains are delayed, whereas in another year no irrigation might be necessary until June or even July, and early strong rains coming along in October no further application of water would be required. It will be seen, therefore, that the orange grower must use his own discretion to a great extent as to the period for irrigating.

It is often stated that the actual amount of water required by irrigation can be gauged by the average rainfall of that section of the country, but growers would be well advised not to put too much faith in this assertion, on account of uncertainty of distribution and incidence of rains. A very large percentage of the rains in Rhodesia are of little value to orange trees, in that it frequently happens that several inches fall within a very short space of time, and consequently most of this runs off into adjacent spruets and rivers, as the earth is unable to absorb it.

Having shown that the application of artificial water is a necessity, it might be advisable to give some idea of when to apply it and some methods as to how it is done. Briefly, an orange tree should never be allowed to show any signs of distress from want of moisture, such as curling up of leaves or wilting. Now, this may occur at any time of the year, even during summer in abnormal seasons, so that it is not possible to state any exact period when water should be applied, as the character of the soil, temperature and many other conditions vary so extensively. For the same reasons, broad statements of the amount of water required can merely be suggestive, and are not to be followed as rules.

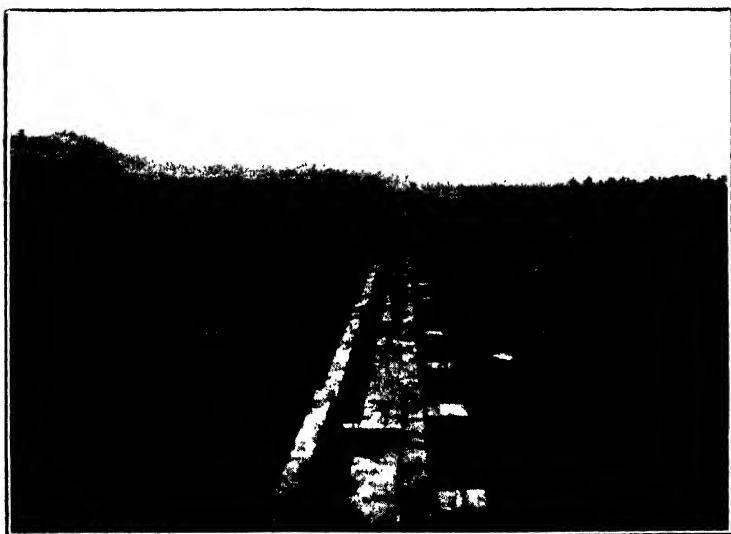
The trees require water at the time of blooming and after, in order to enable them to set and hold a full crop of fruit; further, as an orange takes about nine months to mature, it is necessary to be able to apply water at intervals during the whole of this period up to within two or three weeks of picking the fruit. During the months of June, July, August, September, October and November, when sunlight is practically continuous and growing hotter each day, and consequently evaporation is at its greatest, a most important period in the annual life of an orange tree is passing, so that there is the greatest need for the provision of water during these months.

Roughly speaking, the irrigation of orange trees should commence before blooming and be repeated every month to six weeks until the rains arrive; also during summer if the rainfall is insufficient to keep the trees and crop in good growing order. Whatever the system of irrigation used, the water should soak deeply into the ground.

The benefits resulting from irrigation may be said to be due to the ability to apply water at the right time and in sufficient quantities, so that the regularity of the crop is ensured. There is, in many soils in Southern Rhodesia, perhaps sufficient moisture conserved from the previous wet season to enable the trees to bloom profusely, but not to give them enough vitality to set the fruit and carry it on to



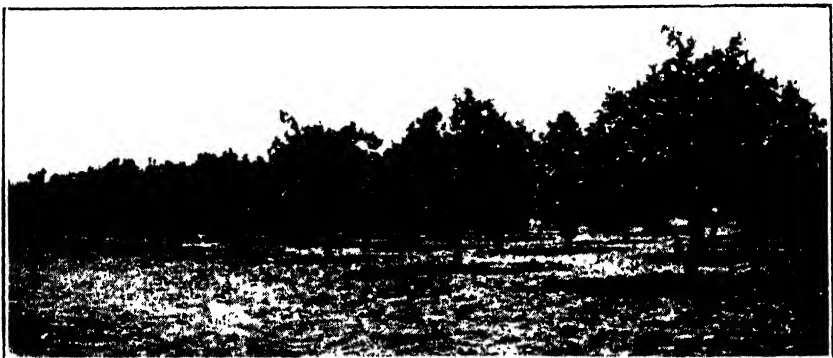
Underground standpipe system of irrigation distributary largely in use in California and installed in a few instances in Rhodesia where an open brick distributary would be ineffective. This illustration shows a line being laid at the Mazoe Citrus Estate.



Open brick and cement distributary. The principle in this method is the same as in the underground standpipe system. This distributary is more economical in construction than underground work, which must be made of concrete, and is likely to be commonly used in Rhodesia.



Orange trees, near Umtah, six years old, well shaped and carrying
good crops



Orange trees, five years old, well shaped except for being pruned
rather far from ground.

maturity. This is a point that some planters in Rhodesia seem to lose sight of, but this particular point makes all the difference between a prosperous orchard and a failure.

The amount of water required to irrigate an acre of full-grown orange trees can be roughly estimated as a quantity equalling 75,000 gallons per acre per application, or approximately a three-inch watering. This may be estimated as the maximum amount required for trees five years and over, while the water required for younger trees will be proportionately less. Thus a very small amount is necessary the first two years at more frequent intervals, while during the next two years the tree will have grown very considerably and may even be bearing some fruit, when it might be advisable to allow half the maximum amount for grown trees. This water duty is given on the basis of delivering the water in pipes, flumes or earth ditches to the immediate vicinity of the trees to be irrigated, but, as remarked above, such figures can only be accepted as approximate. It may be said on this point that in some localities, under certain favourable conditions, one-half the quantities quoted above would be nearer the mark.

The method of applying water is governed to a great extent by the amount available. In orchards that have been properly laid out the best way is by running water in furrows, four or six of these, say, being ploughed between each row of trees, and none closer than four feet from the tree stem; this distance from the trees applies to large bearing trees and can be taken closer for young trees, say, two feet. Before the trees reach bearing age, it is possible to supply water in a modified manner, namely, by drawing a furrow from two to four feet, according to age, on every side of each row of trees. This scheme can be increased as the trees get older by drawing two or more furrows on each side of every row, say, six feet apart. By this means a succession of dams can be obtained, practically covering the whole area of ground. This check system of irrigation can be utilised with a small flow of water as compared with the furrow method, but it is not to be recommended for bearing trees, where the former method can be operated satisfactorily.

I will endeavour to describe only these two methods of irrigation:—No. 1, by furrows; No. 2, by modified form of checks, although there are numerous other methods in use. (See photo and sketch.)

No. 1 Method.—To lay out the orchard for this method of irrigation plough four or six deep furrows between each row of trees, but none closer than four feet to the trees, taking the furrows upon the flattest possible gradient to avoid erosion. This operation can be performed by an ordinary riding cultivator with two or three-furrower attachments. The work is done more quickly by this method, but it has the disadvantage of not going so deep as the plough. As the trees grow most of the space is occupied, and there is then a difficulty in running the furrows close enough to the trees, so that a large space between the rows of trees does not get wetted. The way to obviate this trouble is to cross-furrow with a single furrow plough, along the most suitable diagonals for the purpose, across these open spaces. When the whole block to be irrigated has been thus laid out in furrows, the water is applied slowly, but so

that the water is constantly running over the entire length of each individual furrow without causing any undue washing and a minimum of wastage of water. The time required to moisten the soil depends very largely on the length of the furrows, the nature of the soil and climatic conditions, and may vary from 24 to 72 hours. With a view to facilitating both irrigating and cultural operations, orange trees should not be planted in blocks of more than 10 to 20 acres. The length of the irrigation "runs" may vary from 200 to 600 feet. Where the soil is porous on a moderate slope 300 to 400 feet runs are about right, but in very sandy or gravelly soil on a flat slope 200 feet is enough, while on heavier types of soil, having a fairly steep slope, the runs may be successfully laid out at 500 to 600 feet. Where the gradient is so steep that washing of the soil might result, the furrows should be run on the contour.

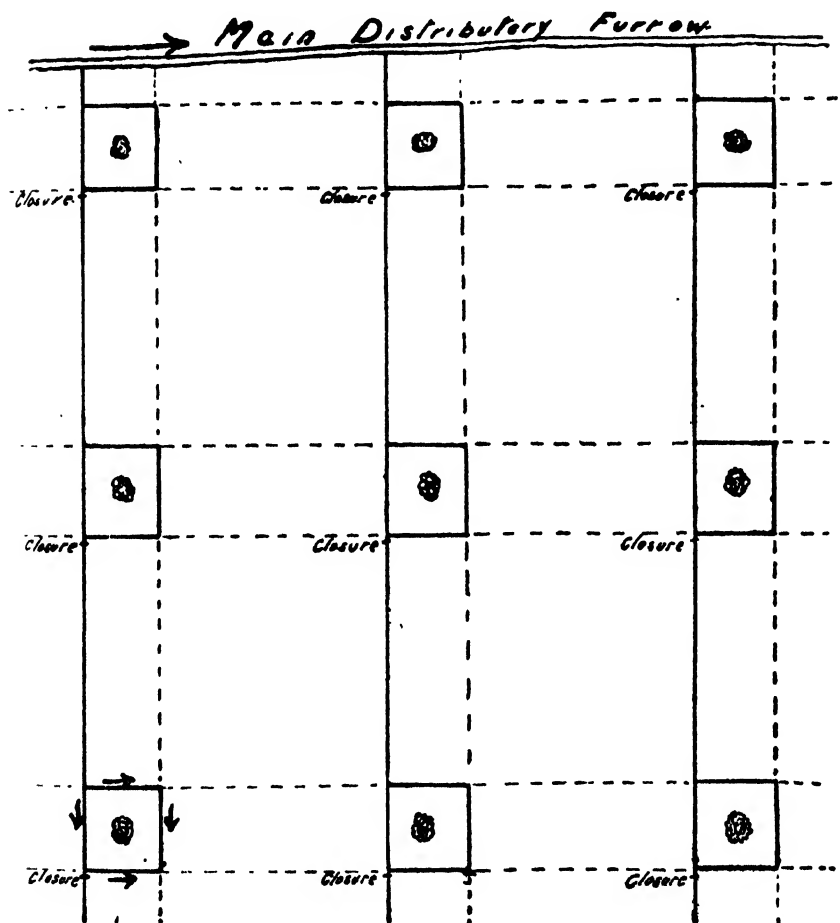
No. 2 Method.—To get the orchard ready for No. 2 system, it is advisable to use a ditching plough with wings on the mould-board, but the plough that is commonly used in this Territory for hilling up mealies would serve the purpose equally well. Draw furrows down every side of each row of trees, and if the plough suggested is properly set, a furrow about two feet broad will be obtained. Where the slope of the ground is so great as to render the soil liable to be washed away, alignment of the furrows should be laid out diagonally. At the intersection of each furrow the earth must be thrown up with a spade, and by this means four dams are constructed, with a minimum of labour, around each tree. All furrows and dams must stand well away from the base of the trees, but covering the space where the roots should be. For older trees, duplicate the whole operations, which will practically give a succession of dams over the whole area.

The water can be applied row by row, or the whole block can be covered at one time, according to the amount of water available, the water being led to the lowest point on the slope of the land first, and so filling up each succession of dams as it is applied, by working up the rows. By this method it is not possible to get sufficient water into the ground by one filling of the dams, so that it is necessary to repeat the dose two or three times until the ground is well saturated. An irrigation half performed is almost worse than none at all, as it is inclined to induce root growth too near the surface, whereas it should be the aim to induce the roots to work well down, as in the event of a drought or anything going amiss with the irrigation supply, shallow-rooted trees will suffer most.

Whatever system of irrigation is used, cultivation must follow as soon as the ground has sufficiently dried out to allow of animals working on it.

It might be advisable to suggest a few ways how not to irrigate. One good way of inducing collar rot is to make basins about the stems of the trees and fill these with water; this method also cramps the root system instead of inducing them to feed far away from the trees, as they should do. Another method not to be recommended is one that was commonly used in the Transvaal some years ago, viz., to lead the water down a furrow or furrows on either side of the trees every few

days, and when the water reached the bottom of the furrow to cut it off and leave the furrow open. When water was applied the next time it was led into the same furrow, and the same practice continued right through the winter. This method is wasteful of time and water, as the greater quantity of water is evaporated; and, moreover, if the water supply for any reason is not available the trees will consequently suffer much sooner than would be the case if water were intelligently applied.



No. 2 Method. The full and dotted lines represent the lines of furrows as ploughed; the full lines represent the lines of furrows actually utilised.

Cultivation.—All work connected with fruit growing must be carried out systematically and a definite programme of work should be adopted and rigidly adhered to. Every detail of working is an impor-

tant item and must be attended to at the right time. There is a right time for all orchard work, and if this opportunity is once missed it is liable to be reflected in the next season's crop and even for longer periods. It is, unfortunately, a not infrequent occurrence for the orchardist to defer working up the land immediately after the rains have ceased. Thus when the delayed work is eventually carried out a good tilth is not obtained. Incalculable harm may be done to orange trees by delaying the autumn ploughing until so late that the ground has become too dry for effective work, and not only has most of the value of the rains evaporated, but the land breaks up into huge clods and it may take more than a whole season to bring the soil back into reasonable condition again. Instances could be quoted where such delays have occurred in cultural operations with the result that the crops of fruit then maturing were impaired and the crops set a few months later were greatly reduced. All cultural practices in fruit growing must be consistently carried out at the right time; delays usually spell loss of crop. These remarks apply not only to cultivation but to all orchard work.

Cultivation is beneficial and necessary in many ways to the general health of an orchard. It pulverises the earth and allows aeration of the soil and roots of the trees, which can then penetrate to all parts of the soil. The water retaining capacity of the soil is also increased and the rain more readily penetrates to the deepest layers, while evaporation is checked by a fine top mulch of soil produced by good cultivation. In Rhodesia we must always be prepared for a possible shortage of rain, and the certainty of a period of six or seven months when no appreciable rainfall can be expected, and we must adapt our system of cultivation accordingly.

Before the wet season arrives the whole orchard should be thoroughly ploughed and cross ploughed, so as to be in a condition to receive the greatest possible amount of rain that may fall. When this ploughing is finished, it is advisable to sow some cover crop, such as kaffir beans, velvet beans, sunn hemp or other legume, over the whole area between the trees, and this should be turned into the land towards the end of the wet season. This not only provides humus and nitrogen, but assists in preventing the washing away of the soil during the heavy rains.

After the beans or whatever other soiling crops have been sown, the land must, of course, be well harrowed. While on this point, I would remark that to avoid erosion of the soil as much as possible where the orchard stands on a hillside, the first ploughing should be done *up and down* the hill, and the cross ploughing *across* the hill, and further, whether a cover crop is sown or not after harrowing the land, a good deep furrow should be ploughed along the centre of each or every other row of trees, according to the steepness of slope, *across* the hill, assuming that the necessary storm-water furrow has been constructed above the whole area. This will help to carry off the surplus rain that actually falls on the orchard during heavy thunderstorms. These furrows should be taken to the ends of each block, where a drain can be made to carry off the water to a convenient donga or some natural water

course. When the rainy season is over the orchard should, if possible, be cultivated about every ten days or two weeks, so as to conserve as much moisture as possible. The trees should also be frequently dug or forked round to prevent the ground from packing. For ploughing or cultivating operations in an orchard, horses, mules or donkeys should be used; the latter are certainly very slow, but, if possible, oxen should not be utilised, as, no matter how careful the driver may be, they will do considerable damage. In any case, if they must be used for want of other tractive power, try and plough one or two furrows near the trees with a mule, or any beast except an ox, hitched on to a small plough, and plough only the centres with oxen.

It cannot be said that so far tractors have been economically successful for general orchard work in Rhodesia or South Africa. Under some special circumstances tractors have proved fairly useful, in that the ground can be expeditiously covered, provided all goes well, and this is a great advantage following on irrigation. However, it may be safely said that the day for the general use of the tractor in this country has not yet arrived.

In ploughing an orchard, care should be taken to perform the operation evenly, that is to say, if the soil is taken away from the trees at the first ploughing, the cross ploughing should be done so as to throw the ground towards them, and when the next ploughing takes place the operation should be reversed. By this means the surface of the orchard can be kept as level as is possible, which will facilitate irrigation and cultivation. Also, ploughing continually at the same depth should be avoided, as it tends to form a hard pan through which neither rain nor artificial water can penetrate. Therefore, set the plough at varying depths at different ploughings, from five to eight inches. The same remarks apply to cultivation.

Whatever happens, weeds should not be allowed to grow in a citrus orchard, or any other orchard for that matter, as they rob the trees of moisture, and, moreover, tend to harbour pests of various sorts. The sowing of a cover crop is a different matter; it is there for the special purposes of holding the ground and supplying humus and other fertilising matter which considerably reduce the fertiliser bill.

Under some circumstances young citrus orchards are successfully inter-cropped, but it must not be undertaken unless proper cultivation is given and manure liberally applied. This enables the man with limited capital to overcome the initial expenses of cultivation and incidentally leads to regular cultivation between the trees. Tall growing plants, such as mealies, should be avoided and inter-crops should be restricted to such as peas, beans, tomatoes, potatoes or wheat, whichever suits the conditions and is likely to be the most profitable.

Fertilising the Orchard.—In the manuring of fruit trees, the first object is to produce thrifty trees, as subsequent fertilising for fruit will not give satisfactory results with poorly grown and partially developed trees.

In order to promote growth, a liberal supply of a complete fertiliser should be used, and the soil kept in the best mechanical condition. When the orchard is in full bearing there is a heavy draft upon the

soil, and to meet this fertilisers should be liberally used. The productive period of an orchard is materially lengthened by the judicious use of fertilisers.

It may be said that in many suitable sites for growing citrus fruit in Rhodesia little or no fertiliser is required until the first crop is borne, which would be, speaking generally, in the fourth year. Previous to this it may have been necessary to apply some fertiliser in small quantities in order to keep the trees in healthy growth; from this period on, however, fertilising the orchard, with organic and commercial fertilisers combined, becomes a serious and necessary attention, if the trees are to give satisfactory returns. It does not pay to allow the trees to so far deplete the soil that their health is impaired, as if this does occur the trees receive such a serious setback that both quantity and quality of fruit are reduced.

The following analysis shows what ingredients it is necessary to return to the soil for every 1,000 lbs. of oranges grown, without reference to any requirements of the soil:—

Quantities of Soil Ingredients withdrawn by Various Fruits.

Compiled from analysis by G. E. Colby, University of California.

Fresh fruit. 1,000 lbs.	Total ash. lbs.	Potash. lbs.	Nitrogen. lbs.	Lime. lbs.	Phosphoric acid. lbs.
Oranges	4.32	2.11	1.83	.97	.53

Fertilisers for Citrus Trees.

(A) For young trees—	lbs.
Sterilised bone dust (containing $3\frac{1}{2}$ per cent. nitrogen and 20 per cent. phosphoric oxide)	500
Double superphosphate	80
Sulphate of potash	300
	<hr/>
	880

Apply the above mixture at the rate of 3 lbs. per young tree.

(B) For trees in bearing—a light dressing—	lbs.
Double superphosphate	150
Dried blood	150
Sulphate of potash	100
	<hr/>
	400

Apply the above mixture at the rate of 5 lbs. per tree.

(C) For trees in full bearing—a heavier dressing—	lbs.
Double superphosphate	250
Dried blood	200
Sulphate of potash	150
	<hr/>
	600

Apply the above mixture at the rate of 8 lbs. per tree.

During a recent visit to California it was observed that the objections that obtained there up till a few years ago with regard to farmyard manure for use in citrus orchards have been entirely ruled out, and actual results in the last few years have proved the absolute necessity of supplying organic fertilisers, together with commercial fertilisers, regularly in large quantities, and where obtainable farmyard manure has proved the most reliable. It was clearly shown that orchards were retrogressing very seriously, in fact in places were becoming practically non-remunerative, on account of continuous clean cultivation, combined with heavy applications of only commercial fertilisers, which are said to have devitalised the trees.

In Rhodesia our climatic and soil conditions are more favourable, but, while we may not require manure in such large quantities per acre, it is recommended that applications be given before trees begin to retrogress, and be continued at regular intervals. At the same time it is well to explain that the use of farmyard manure on orange orchards without the addition of other fertilisers is liable to produce coarse growth and coarse, sour fruit.

The quantities applied in California are large; annual dressings vary from 15 to 30 tons of farmyard manure per acre, applied in furrows—if broadcasted, twice the quantity or even more per acre is required, with less satisfactory results—plus 15 to 40 lbs. of a complete commercial fertiliser per tree.

It may be explained that in Rhodesia we are able to grow good cover crops during the wet season at a minimum cost, whereas this useful means of assisting the trees has generally to be grown in California under irrigation, and is therefore not resorted to as frequently as it might be on account of shortage of water. The addition of lime is in most parts of Rhodesia beneficial and even necessary every few years.

During the last few seasons orange trees in Rhodesia, which had become poor in growth, also in quantity and quality of fruit, have received approximately seven to eight tons of kraal manure per acre, plus 8 lbs. complete fertiliser, and show improvement in every way. The addition of wood-ash, about half a sackful per tree, has also been used with success in place of the commercial fertiliser.

Until further data are collected, it is recommended that orange trees for the first four years be given 2 to 4 lbs. commercial fertiliser, if necessary, in order to keep the trees in full growth. From that time onwards it is advisable to consider the use of organic manures, in addition to the other fertilisers. It is recommended that a dressing of four to ten tons of well rotted kraal manure per acre, plus 5 to 15 lbs. of a complete commercial fertiliser per tree, be applied annually, according to age and condition of orchards.

The most suitable time to apply heavy manure is, if it can be so arranged as to conveniently fit in with other work, after the crop is harvested, while commercial fertilisers should be applied, generally speaking, during the spring after an irrigation. The simplest and most beneficial method to adopt in applying heavy manures is to plough

a furrow, with a single furrow plough, outside the hang of the branches, along each side of every row of trees, and follow this up with a wing-shovel plough; this provides a trench all round every tree. The filling in with manure is best done from a light wagon; when completed the trenches should be finally covered by ploughing a furrow along each side. As the trees grow older, however, one large furrow twelve to fifteen inches in depth, located in the middle of each tree row, is much to be preferred to the two shallower furrows described above; for this purpose a double-mouldboard ditching plough is required. The object in making one deep furrow is that it occasions the development of a strong fibrous root system, which feeds on the fertiliser in the furrow below the ordinary ploughed surface, where it is undisturbed by plough or other implements.

If leguminous cover crops are used, nitrogenous fertiliser can be very considerably reduced for both young and bearing trees. It is possible in many parts of Rhodesia to still further reduce the fertiliser bill by the application of wood ashes, quantities of which are occasionally available. Wood ashes are valuable in potash, phosphoric acid and lime, but are exceedingly variable in composition, soft-wood ashes being less valuable than hard-wood ashes. Apply at the rate of 75 to 100 bushels of wood ashes per acre, according to age of trees and composition of ashes.

Fertilisers to young trees are best applied by scattering the material by hand from a radius of about 18 inches to 2 feet from the stem of the tree, to about 18 inches to 2 feet outside the spread of the branches, and then digging it under. With older trees, whose roots should be further extended and even cover the whole area of land between the rows of trees, the fertiliser should be applied broadcast by hand, or by the use of a "spreader," and then incorporated with the soil, as soon as possible, by ploughing or cultivating.

It is best that no fertiliser be applied to older trees closer than three to four feet, as injury may result to the crown roots.

Pruning.—While the orange tree requires less pruning, when once established, than most other fruit trees, it is very necessary to attend to it constantly in the first stages of its life in the orchard. The accompanying photographs illustrate this point fairly well. Figures 1 and 2 show two young trees in the nursery large enough to be planted out in the orchard; figures 3 and 4, young trees after being planted in the orchard and pruned to correct height—two feet six inches. With trees as shown in figures 3 and 4, if the leaves drop on to the stems at the time of transplanting, the trunks should be protected from the sun by white washing or by covering with newspaper or hessian. Figure 5 shows a tree received from the nursery with head already formed; the marks show the points at which these side growths should be cut back. Figures 6 and 7 show fairly well-shaped trees of three and four years old.

The best time to prune young orange trees is in June or July, and older-bearing trees after the crop has been taken off. All pruning tools should be the best obtainable, and must be kept sharp to do good work. When pruning, great care must be taken that a clean cut is made, and

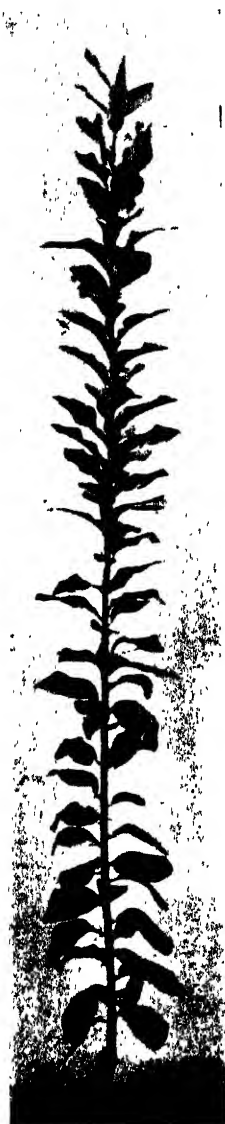


Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4

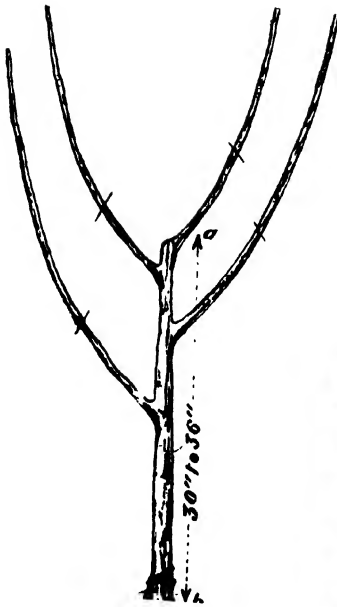


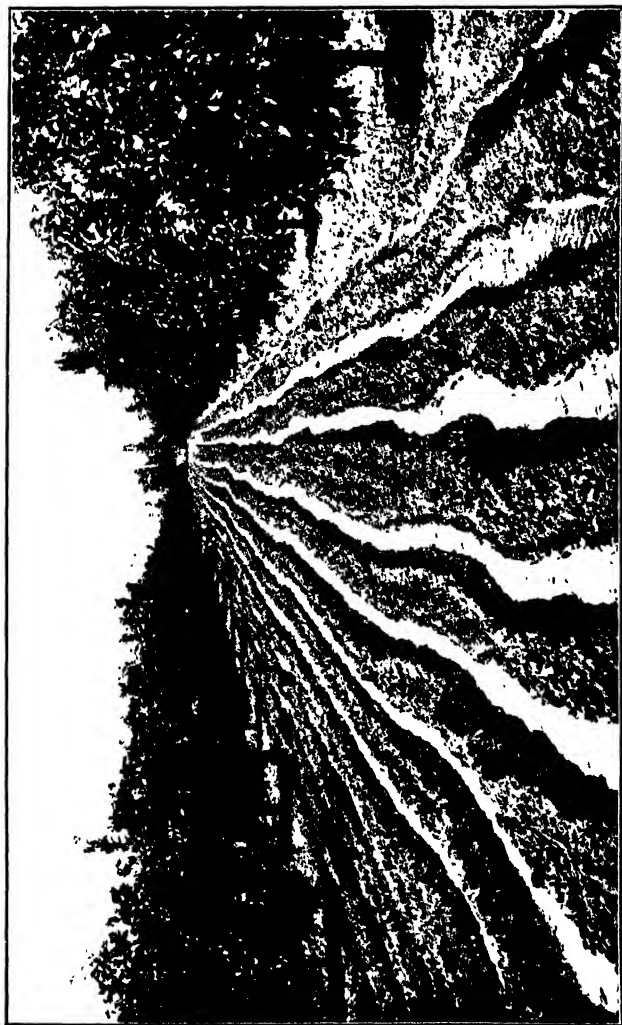
Fig 5



Fig 6



Fig. 7.



No. 1. Furrow System. A small stream is allowed to run down the furrows constantly for three days, permeating the soil throughout without washing away the elements of plant food.
(From Professor Wickson's "California Fruits.")

no stubs an inch or two long left, that is to say, make the cut right against the limb from which it is intended to remove a portion. All cuts over half an inch in diameter should be painted over immediately, to exclude air and water, and so prevent decay; any old paint will do, mixed a little thicker than for ordinary use, so that it will not run. Pruners are warned against the indiscriminate use of ready-made green paints, in which there is liable to be too much Paris green, thereby causing burning of the bark, and possible injury to the whole tree.

All dead wood should be removed at pruning time, as should water shoots, although sometimes one can make use of some of these to take the place of broken or misplaced branches, when they should be cut back and trained in the direction required. Beyond cutting out dead wood and water shoots, a bearing orange tree that has been properly and regularly pruned from the time of planting requires very little pruning except a judicious thinning out. It should be remembered that the best fruit is often found on the inside of good orange trees, and the only way to attain this condition is to prevent the foliage getting so dense that light cannot get in. It is not intended to convey the idea that an orange tree should be opened up in the same manner as a deciduous fruit tree, as that would be fatal. An orange tree cannot stand the direct rays of the hot sun on its branches, but if the tree is kept so that one can see well into the interior from all sides and yet have plenty of shade for the tree, it will have the ideal shape, and it will be possible for fruit to be borne on the inner branches; in addition to this advantage, it is possible to spray the tree satisfactorily when necessary.

Spraying and Fumigating.—It must be clearly understood that spraying and fumigating are just as much a part of the curriculum of citrus orchard work as any of the other cultural operations. Some growers are under the impression that there are more pests to contend with in this country than elsewhere, but this is not so, and provided ordinary reasonable attention is paid it is no more difficult to control any attacks than in other parts of the world. In all countries where fruit growing is carried on commercially spraying or fumigation of the trees is recognised as part of the regular orchard expense and considered as a form of insurance against loss. If trees are allowed to be neglected for want of cleansing of either insect or fungus troubles, it cannot be expected that returns will be satisfactory.

When spraying or fumigating is undertaken it must be done in no half measures and must be repeated at intervals until the particular trouble has been got rid of. Various fungi are the cause of considerable trouble and need careful watching in order to be controlled before damage occurs. Both soft brown scale and black aphid are perhaps our worst enemies and are the cause of a great deal of fruit being rendered unfit for export, by reason of the black sooty fungus which follows these pests; the only way to get rid of this fungus is by controlling the original cause. There is no doubt the black aphid is one of the limiting factors in the production of full crops of oranges in Rhodesia, and it is therefore essential to be on guard against this pest, which may appear at almost any period, although it is perhaps at its worst before the rains

commence or during other long dry spells. An infestation may occur just previous to or during the blossoming period, when irretrievable damage may be done unless the pest is checked; tobacco and soap wash is a standard remedy for this purpose at any time of the year.

During extremely hot periods, which are not infrequent in Rhodesia, it is not advisable to spray during the heat of the day, as severe scalding may result. It is quite practicable to commence very early, knock off from 10 a.m. to 4 p.m., work again until dark, and yet get in a day's work.

Speaking generally, in well-tended orange groves in Rhodesia red scale is not so serious a menace as soft brown scale. In order to safeguard trees against insect pests and fungus troubles and control disease as far as possible, it is recommended that all trees be sprayed about the beginning of the dry season and again towards the approach of the wet season, whether infested or not, and, if possible, the material used should be a dual purpose mixture, i.e., a combination insecticide and fungicide. It should be stated that fumigation with hydro-cyanic acid gas is more effective in controlling scale on citrus trees than spraying, and when practicable should take the place of spraying for this purpose. It should be recognised that systematic spraying of all orange trees, for guarding against possible outbreaks of insect and fungus troubles, is an essential part of the regular routine work of all orchards. Intermediate sprayings or fumigations need only be carried out as the occasion arises to control any particular trouble.

Lemon Yeast.

The juice of one large lemon, one breakfast cupful warm water, one teaspoonful of white sugar, half teaspoonful flour, half teaspoonful salt.

Method: Mix flour, sugar and salt with lemon juice, then add warm water and a little old yeast to start with, or failing that, three raisins, and when it has risen well, use for bread. It is always best, I find, made freshly after about three times in use; by this I mean don't keep adding to the old lemon yeast, but make a fresh start. This yeast makes bread very white, and is very excellent and good for people who suffer from indigestion.—From Mrs. J. McClellan, Bulawayo.

Report of the Director of Agriculture for the Year 1921.

Conditions in 1921.—Throughout the year natural conditions were uniformly favourable; only economic factors were adverse. The rainfall in quantity and distribution was propitious, the winter mild, grass abundant, veld fires less frequent than in past years, and water was plentiful throughout the dry season. Consequently the increase of stock and the yields of crops were alike satisfactory. Unfortunately the British markets were glutted, and showed no preference for Colonial against foreign producers; European markets were largely closed owing to financial causes; freights for produce by land and sea were high and much beyond what the traffic could bear, discouraging further production where it did not altogether prevent removal of commodities already grown. Supplies from overseas, particularly essential agricultural implements, machinery and necessities not producible locally, continued so dear as to restrict purchases to a level which militated against development. The principal and most ruinous fall in prices of products occurred in the case of our chief staples, maize and cattle, the twin pillars on which the structure of our agricultural industries rests. A fall in land values was a natural and immediate consequence, reluctantly recognised by sellers. The unfavourable position resulting was most acutely felt by beginners, although well established farmers also suffered. Prospective settlers found difficulty owing to hard times in liquidating assets at Home with which to take up farming here, and this fact has undoubtedly retarded settlement. To these unfavourable features must be added a certain quietness in mining interests, on which the farming population so very much depends, a depression also mainly due to extraneous causes. It is some comfort to realise that the state of affairs indicated above as prevailing throughout 1921 is in no way the fault of Southern Rhodesia, but of outside influences and causes which in their very nature may be considered to be of a transient character.

Outlets for Products.—Southern Rhodesia is pre-eminently a cattle country with a great future for meat, but fortunately for those who need rewards for their labours more rapid than can be derived from breeding beef, good, sure and quick returns are normally afforded by arable farming through maize, wheat, ground-nuts, tobacco and citrus fruits, whilst dairying, pigs and poultry also bring quick profits. These various lines are to-day established ordinary, practical propositions no longer experimental or doubtful. The difficulties now being faced are the very outcome of our success in solving our preliminary troubles, and are largely due to the magnitude of our production. Rhodesia produces many useful commodities, but now requires better

facilities for exporting perishables and for economical handling of bigger quantities of all products than have hitherto been dealt with.

Having proved the possibilities and ascertained the best means of production, the country is now faced with the need of adequate outlets for its surplus beef, bacon, butter, oranges, maize, ground-nuts, sun-flower, oil, tobacco and cotton. Great Britain has urged production within the Empire, and Rhodesia has responded liberally to the appeal, but now little or no corresponding activity on the part of Home buyers to favour the Colonial producer has been shown. Manufacturers apparently buy what is brought to their doors without much enquiry as to origin, and take no pains to secure our products in preference to foreign articles, although apparently expecting such treatment from us. Imperial Trade Commissioners have visited the country in the interests of British manufacturers, and commercial houses send out agents to sell goods to us, but not to buy our products. The farmer is obliged to send his products and crops overseas to seek a market, in doing which he is at a great disadvantage in dealing with business affairs beyond his own proper sphere. Farmers cannot command the best terms for land and ocean transport and for sale and finance that might be obtained by powerful mercantile bodies. In the case of beef, butter, tobacco, cotton, maize and other grain resort has been had to co-operation to secure these benefits, but the results have, owing to a variety of causes, not proved unqualified successes, though undoubtedly better than individual effort. If the English buyer does not make some effort to secure the products of Southern Rhodesia, he cannot be aggrieved if markets are sought and found outside the Empire, and in countries of his commercial opponents and industrial rivals.

Refrigeration.—Not only for our pressing need for export of beef, but also for our growing surplus of butter, bacon and oranges, it is now urgently necessary, following the experiences of other countries, to provide some system of freezing works, cool transport, cold storage or pre-cooling, as the case may be, both in the country and at the port. This is a matter of the utmost concern to the farmer, but one which is perhaps more properly an industrial or commercial undertaking. Without such refrigeration facilities not only must agricultural development be hindered, but the existing products actually now being grown and already in existence in the form of cows and oxen, pigs and orange trees, food for the cattle, land prepared for orchards and for crops, and all the agricultural development that these connote, must seriously suffer, profit be lost, and progress be retarded. On the other hand, there is every reason to anticipate good returns from such commercial undertakings, since, as our statistics prove, the quantities concerned are material and increasing.

The Season.—The rainfall, which commenced late and so adversely affected the planting season, proved ultimately more copious and prolonged than usual, thereby in large measure enabling crops to recover. In many districts, notably in Matabeleland, the crops proved more heavy than usual, whilst the late rains benefited the winter veld to a very marked degree. At the end of the year rains for the following

planting season were exceptionally abundant and favourable, and the planting of maize, tobacco and other crops was carried out under exceptionally favourable circumstances.

The study of weather conditions has now enabled the country to be divided into six distinct zones in regard to which the rainfall returns are prepared and published regularly, so as to give residents in each zone a general idea of their position in this important respect. The first of these zones is the north-western drainage area of the Zambesi (western Matabeleland); the second is the south-eastern drainage area into the Limpopo River (eastern Matabeleland); the third includes the northern drainage of the Zambesi (western Mashonaland); the fourth the north-eastern drainage area of the Mazoe and Ruenya Rivers (north-eastern Mashonaland); the fifth embraces the southern drainage area to the Sabi (south-eastern Mashonaland), and the last area includes the eastern slopes facing Portuguese territory (eastern border). This sub-division has been found a very useful and correct one in regard to climatic conditions.

Legislation.—Agricultural legislation passed in the Legislative Council during the year consisted of the Registration of Pedigree Live Stock Ordinance, legalising the position of the South African Stud Book Association and allied stud breeders' societies of the Union in Rhodesia, and the Produce Export Ordinance, which is designed to furnish exporters with certificates in regard to the quality of any agricultural produce they may send away, and to prevent the export to other countries of agricultural produce of inferior quality. It is hoped in this way to establish and maintain the reputation of the produce of Rhodesia in foreign markets, a system which has done so much to establish agricultural industries in other countries. The farming community is also closely concerned with the Road Councils Ordinance and Vehicles Tax Ordinance, which became law during the same session.

Land Ownership.—During the year an examination was made by the Statistician of the condition of ownership of land in Rhodesia, as the outcome of which certain interesting particulars have been ascertained.

The total area of Southern Rhodesia is slightly under 100,000,000 acres. Of this land nearly one-fifth is set apart permanently as native reserve; one-fifth is used by Europeans, and the remaining three-fifths is not in use, although it consists partly of alienated as well as unalienated land. Nearly one-half of the entire country has not yet been alienated, and one-third is held by individuals under various titles.

About one-fourteenth of the country is devoted to general farming, one-eighth to cattle raising by Europeans, and one-eighth is privately owned but is not in use. This latter area, containing much useful land, is held partly speculatively, partly for revenue in the form of rents by native tenants, and must be regarded as not under beneficial occupation. There are indications of an increasing tendency to subdivide and dispose of such locked-up land, which is to be found fairly uniformly distributed over the two provinces.

It is interesting to find that in Mashonaland there are seven-and-a-half million acres devoted to ranching as against four-and-a-half million acres so used in Matabeleland, whilst another million-and-a-half acres are in process of transfer to a number of applicants desiring it for cattle raising purposes. Cattle breeding is generally more advanced in Matabeleland. The area devoted to mixed farming in Mashonaland exceeds four million, eight thousand acres, and is considerably more than double of that so used in Matabeleland. Figures relating to these and kindred questions have been prepared in detail for every district of the country and have been published. It will no doubt be of interest in time to watch the gradual transition as the land is taken up and the proportions given above alter as settlement proceeds.

Cattle.—The number of cattle in Southern Rhodesia at the end of the year 1921 was 1,713,638 head, of which 859,140 were European owned and 854,498 native owned. The grazing throughout the year was excellent, whilst the health conditions were on the whole good.

The present position of the cattle industry of Southern Rhodesia—fully realised by those most concerned—is that there is a steadily piling up surplus of the finished product, slaughter cattle, beyond our present outlets, and that the existing opportunities for export are inadequate to meet the pressing need for a vent for our ever-increasing herds. This impending glut is the very outcome of our prosperity, and not the consequence of passing circumstances. It is therefore imperative for the prosperity of the country to find a permanent solution. Progress is not only in numbers, but also in quality and in early maturity. It is recognised that there is still a large proportion of compound and canner cattle, but every generation and every year is seeing a larger proportion of improved stock, and there is to-day quite a considerable proportion of freezers and chillers available.

The prospects of the cattle industry have during the year been the subject of study and review by a public committee which, as a result of extended enquiries, issued a memorandum giving a concise, descriptive and statistical statement of the present position and furnished a mass of information which points forcibly to the conclusion that the time is now ripe for the advent in one form or another of the meat export business, and for the establishment within Southern Rhodesia of a freezing works with all its side lines as found in other stock-raising countries, such as Australia, the South American States and Madagascar. The fullest statistics being given in the above-mentioned memorandum, it is unnecessary to repeat them here.

The recent effort to improve and stabilise the markets in the south through the formation of a Meat Producers' Exchange must to some extent re-act on the stock owners in Southern Rhodesia, and is therefore to be welcomed, but in spite of the declaration of its opponents that it was intended specially to assist the Rhodesian cattle owners to find a market on the Rand, it has not in practice had any marked influence in this direction; indeed, the number of cattle sent there last year was less than one-third of that in the previous year. It has become evident that the Union can in normal seasons more than meet

its own needs, and that apart from other considerations the distances from Southern Rhodesia to Johannesburg or Maritzburg involve great loss of weight, condition and quality of live cattle, besides much cruelty. Slight extensions of our local markets for cattle have been secured, but, helpful as these are, they by no means adequately meet the needs of the case. Additional quarantine markets in the Union were made available for Rhodesian stock, but no sale in the open market is yet permitted. Prices in the Union fell owing to abundant supplies, and Rhodesia, as the most remote source, felt the effect first and most severely. After prolonged negotiations some relaxation of the embargo in Northern Rhodesia has been agreed upon whereby, subject to certain restrictions, our cattle are to be admitted into that territory, and also allowed to pass through it to the Congo. Improved facilities have also been arranged for export of our cattle into Mozambique Company's territory, but this is only a very small market. These facts are fully realised by those concerned, but so far no adequate measures have been taken to overcome the impending glut. Meantime the surplus above our own requirements is mounting rapidly, and a solution of the problem is becoming urgent. The number exported in 1920 was 37,285 head, and our local consumption is about 75,000 head. In 1921 the export, instead of becoming greater, was only 12,637 head in all, of which 8,727 only were for slaughter. A serious accumulation took place, therefore, of not less than 25,000 head of slaughter stock over and above the yearly natural increase. During 1921 there must have been not less than 121,000 available for slaughter on the conservative estimate of 8 per cent. of the numbers existing at the beginning of the year. Export and local consumption only took about 87,000 head, leaving some 34,000 head as a carry over for 1922. On the same basis, 8 per cent. of the total at the beginning of 1922, there should be 137,000 mature and fit for slaughter during the year, of which 62,000 are available for export; whilst there is no prospect of sending away more than went in 1921, that is, 9,000 head for slaughter. Even if these figures are, as they must be, only hypothetical approximations, yet it is safe to say that there is a very large and constantly growing surplus.

Our exports are not only failing to keep pace with our natural increase, but are actually diminishing. There is thus a surplus piling up which must find an outlet some day at any price. The price of the finished ox must very largely be the determining factor in fixing the price of land, the price of breeding stock and the spending power of a large section of the community. It must, therefore, materially affect the prosperity of the country.

Not less important than the question of an outlet is the need for good bulls. Owing to the prevalent fancy prices in Great Britain and the fact that high-class stud cattle are becoming more and more readily obtainable on the spot, importation of pure-bred bulls and females from the homes of the breeds has dwindled continuously for the past five years. On the other hand, importations from the south have of late been increasing, particularly in bulls, which numbered last year 592 from the Union against 36 from Great Britain. The figures for total importations are shown below:—

	1917	1918	1919	1920	1921
From Great Britain	199	155	138	96	58
From Union of S.A.	2,766	865	651	836	948
Total	2,965	1,020	789	932	1,006

The existence of excellent pedigree herds within the country—to-day there are 8,539 pure-bred cattle in Southern Rhodesia—must be taken into account in studying these figures.

From the statistics for the past year it is interesting to find that 58.9 per cent. of European owned cattle in the country are females; 10.3 per cent. are bulls. Of all oxen, 69 per cent. are not trained to work, but raised only for slaughter, and the proportion of these is rising. The following particulars for European owned farm live stock as at 31st December, 1921, are of interest:—

	Number.	Increase or decrease over previous year.
Cattle	859,140	+ 11.1 per cent.
Horses	3,008	+ 4 ..
Mules	2,292	8 ..
Donkeys	9,446	+ 3.6 ..
Sheep	49,733	+ 13 ..
Goats	17,673	- 9 ..
Pigs	24,896	+ 40.1 ..
Poultry	150,746	+ 37.8 ..

Dairying.—The dairy industry has received a considerable stimulus not only from the gradual opening of overseas markets, but also from the low prices of maize and the difficulties foreseen in the way of finding markets for beef cattle. There has been an increase of about 20 per cent. in the number of pure-bred dairy bulls, mainly purchased by farmers for the purpose of grading up the herds and adding to their milk-producing capabilities. The Dairy Expert has initiated an elementary scheme of milk recording which it is hoped will impress dairy farmers with the importance of knowing exactly what their cows are producing, and will lead to improvement in the productiveness of their herds. The three competing butter factories in the country were amalgamated during the year under the auspices of the Farmers' Co-operative Industries, a step which should no doubt lead to economy of production, as butter-making is essentially a trade to be conducted on as large a scale as possible, and one in which factory methods are very preferable to farm or home processes. A number of small cheese factories have come into being in the country, one with a capacity of 500 pounds per day, and there is every prospect for the extension of cheese-making, though for the present mainly for local use. The export trade in butter is now assuming large proportions, and has during the past few years been steadily rising, as shown by the following figures:—

	Pounds.	Value.
1918	107,525	£10,598
1919	126,552	12,536
1920	205,098	29,312
1921	421,815	47,165

Pigs.—The pig industry has made notable increase in conjunction with dairying and on account of the low prices of maize. The total value of pig products made in the country approximates £65,000, whilst exports of bacon and ham exceed £10,000 in value, and are double what they were two years ago. The bacon factories are now refusing to take in inferior pigs for bacon production, and the farmers are realising that badly-bred and badly-fed pigs are unprofitable in every way.

Poultry.—During the year there has been exceptional increase, improvement and prosperity in the poultry industry, and much progress can be recorded both in the number of poultry farms, in the number of birds, in egg production and in skill and knowledge of poultry keepers. The profits of poultry now provide a material portion of the income of many farmers and townsmen. The production of eggs has approximately been doubled during the year, and the improvement in weight and quality of the eggs is very marked. The production is now sufficient for local requirements, although it is to be noted that there is still a considerable number of importations of very inferior eggs from the Union of South Africa both into Rhodesia and through it to the Congo to the market which, geographically, our poultry farmers should be able to supply entirely. As numbers continue to increase, and the organisation of the trade improves, no doubt this country will supply the Congo with its requirements both of eggs and poultry meat, and will probably be in a position ere long to export overseas.

The first Southern Rhodesia egg-laying test was brought to a successful conclusion, and the second one is now in progress. Very remarkable results were obtained, comparing favourably with those in other parts of South Africa and in foreign countries. These tests have demonstrated that eggs can be produced at all seasons of the year with ordinary methods of feeding and treatment such as can be followed by anyone, and also that the climatic and other conditions here are admirably suited for this branch of farming. The test has also gone far to assist in the expansion of poultry farming, and has afforded an excellent demonstration of the methods most suitable for the running of poultry here, as those pursued were by no means beyond the reach of any practical man.

The services of the Poultry Expert are very much in demand for visits, lectures and advice, and there are few branches of farming which respond so readily to educational work or which are so directly helped thereby. The poultry shows held in different parts of the country have been most successful and useful, and poultry farming may now be regarded as well established in this country.

Crops.—The year proved a better one for arable farming than even its predecessor, which had been the best till then recorded. This is indicated in the figures given below, which deserve individual examina-

tion, and which indicate a very satisfactory position and good progress, in view of the difficulties of the times:—

CULTIVATED CROPS IN ORDER OF AREA.

Crops.	1920-21.		1919-20.	
	Acres.	Acre yield.	Acres.	Acre yield.
Maize	186,246	6.55 bags	173,467	6.45 bags
Tobacco	9,531	350 lbs.	7,504	390 lbs.
Wheat	7,118	3.9 bags	5,139	3.33 bags
Maize (silage)	6,305	4.36 tons	4,955	3.17 tons
Ground nuts	4,414	8 bags	2,430	6.8 bags
Sunflower	3,974	5.8 bags	1,826	6.7 bags
Potatoes	2,077	23 bags	1,823	23.4 bags
Pumpkins	1,594	9 tons	1,801	5.4 tons
Beans	2,285	3.2 bags	1,789	2.04 bags
Cattle melons	1,204	8.4 tons	1,698	5.7 tons
Sweet potatoes	712	18 bags	1,115	9.2 bags
Oats	1,616	...	1,402	...
Napier fodder	825	...	1,012	...
Teff grass	1,128	...	968	...
Velvet beans	1,889	...	581	...
All other crops	10,944	...	3,584	...
	241,862		211,094	

A gratifying feature is that, with the steady expansion of land under maize, there is yet a higher relative area devoted to other crops, which has increased during the last three years from 15.6 per cent. to 17.8 per cent., and now to 19 per cent. of the total area under cultivation; whilst the 81 per cent. devoted to maize, 2.6 per cent. is used for silage and 78.4 per cent. for grain. These figures indicate the steadily increasing appreciation and practice of rotation by our farmers. Already practically one-fifth of the cultivated land is under crops other than maize, which must lead to the better maintenance of fertility, to the increase of our self-supporting capacity, to economic improvement in our methods, and a better balance in all farming operations. This tendency to grow a greater variety of crops is not taking place at the cost of maize production, which has continued to expand, but is attributable to a realisation of the possibilities of other crops and the requirements of good farming, and to appreciation of the strenuous teachings of the experts of the Department brought home by the present situation in regard to the markets.

Maize.—Maize for grain exceeded all previous years, in quality and quantity, in yield per acre and in acreage cultivated. The total crop grown by Europeans amounted to 1,220,678 bags, or 6.55 bags per acre over 186,246 acres. These returns are highly satisfactory so far as production is concerned, but it is unfortunate that little, if any, diminution in the cost of production took place, and that a great fall

in values occurred, leading to little profit to the farmers and reducing a number of them unfortunately to grave financial straits. A vehement discussion, embittered owing to the low world's prices, arose in regard to the cost of production of maize. No finality was reached, but the common conclusion of the matter was extraordinarily well stated by the president of the Enterprise Farmers' Association, Mr. J. W. Richardson, when he said: "To me the question is both an idle and a futile one; there are so many varying factors, so various as there are farms and farmers, that any answer forthcoming would be useless to anyone. At the same time it is an all-important matter to the individual farmer to know what it costs him to produce a bag of maize, for it will partly determine whether he will grow it or not." The sensational fall in prices has led to a corresponding fall in land values, and affected particularly unfavourably the newer settlers in the country. Once again Rhodesian growers proved their great pre-eminence over all rivals at the Johannesburg Maize Show, an exhibition which was far surpassed in numbers and quality of exhibits by the show held at Salisbury, where Rhodesian varieties naturally predominated to the exclusion of types grown only in the south. For three consecutive years now Rhodesian exhibits of the breeds common to both countries have proved victorious at the Rand show, and the superlative quality of our maize is now freely admitted by judges, buyers, millers and rivals. The high position which maize production has attained in Rhodesia deserves to be better appreciated in Europe, but unless some pecuniary reward for superior quality can be secured, there seems little object in establishing a high reputation or in continuing our efforts to attain a high standard.

Maize Grading.—The practice of grading maize and maize meal for export has been in force for some years, but has now been placed on a better footing by the passing of the Produce Export Ordinance, and the appointment of two permanent graders. From time to time, as the circumstances of the export trade require, the system of grading is being altered, and further improvements are now under consideration. Farmers are showing commendable care in endeavouring to raise the general quality, with most satisfactory results, as is shown from the fact that from 555,635 bags examined 58.4 per cent., a phenomenal proportion, passed the very high standard allotted to first grade maize; 36.3 per cent. were second grade, itself a high class; only 1.5 per cent. were third grade; 3.8 per cent. were rejected. Farmers are now able to discriminate, and do not put forward so much inferior maize for inspection. In addition to grain, 143,357 bags of maize meal were inspected, bringing the entire quantity graded to 698,992 bags.

Wheat.—The production of wheat has been steadily advancing during past years, as is shown in the accompanying figures:—

Production of Wheat.

Year.	Acres.	Estimated Yield.	Bags per acre.
1917	4,655	15,425	3.3
1918	5,020	13,806	2.7
1919	4,394	13,432	3.0
1920	5,139	17,142	3.3
1921	7,118	28,400	3.9

Last year the yield was the highest since official figures commenced to be collected in 1914. On certain farms in the Inyanga district the return reached the high figure of 14 bags to the acre. Importations of wheat and wheaten flour and meal for the year, less exports of the same, represent a total of 48,892 bags, giving a total consumption in Southern Rhodesia of 77,292 bags. At the present rate of increase it should not be long, therefore, before Rhodesia is in a position to meet its own needs for wheat. It is interesting to learn that in several districts natives are now growing this crop for sale to Europeans.

Oil Crops.—The production of oil crops, notably ground-nuts and sunflower, is only limited by questions of markets and freight. The desirability of growing such crops in rotation with maize is fully recognised, only the direct profits and outlets remain uncertain, and tend to limit cultivation. Two factories are now dealing with oil crops; the resulting cattle cake commands a ready sale, but the marketing of the oil still presents some difficulty. Ground-nuts have been exported overseas this year, the first time that this has happened.

Tobacco.—The rapid expansion of the tobacco industry is indicated in the accompanying table:—

Production of Tobacco, 1918-21.

Season.	Acres Virginian.	Acres Turkish.	Total acres.	Yield Virginian.	Yield Turkish.	Total yield.
1917-18 ...	2,434	813	3,247	415,210	204,961	620,171
1918-19 ...	3,198	999	4,197	1,179,932	287,680	1,467,612
1919-20 ...	5,546	1,958	7,504	2,435,994	511,633	2,947,627
1920-21 ...	7,888	1,643	9,531	3,192,662	554,320	3,746,982

From these figures it will be seen that the latest tobacco crop is also the largest ever produced. "In this connection," says the Tobacco Expert, "it should be pointed out that the production of tobacco in this Territory has now reached the maximum amount required by the South African market, and if the industry is to continue to expand, overseas markets must be developed. For export trade the average quality of the leaf produced must be greatly improved, in order that Rhodesian tobacco may find a remunerative market. Even if the low-grade leaf, which makes up a high percentage of the present production, could be sold on the overseas markets, the prices realised would not be profitable on account of the heavy transport and other charges. The production of low-grade tobacco is due to several causes. Many growers increase their acreage in excess of their curing facilities, and consequently produce a large percentage of badly-cured tobacco. Most growers do not use sufficient fertiliser per acre to produce the maximum yields, and produce low returns of very small leaf which is unprofitable. The average grower attempts to increase the yield per acre by topping the plants too high. The results are the opposite of those anticipated, and the leaf produced from plants topped too high is usually of very poor quality."

Last season the Virginia tobacco was seriously damaged by a bacterial disease, to combat which the Department of Agriculture undertook the treatment of tobacco seed free, involving a considerable amount of

work, which is being justified by results. The process is the only one which scientific investigation in America has so far indicated as being a preventive of the mysterious trouble which has in the course of the last couple of seasons traversed the tobacco-growing countries of the world.

Growers are being encouraged to grade their leaf on the farm, thereby very much facilitating the work of the warehouse, and this practice is likely to increase and to improve as farmers gain experience of the processes. The handling of the leaf at the warehouse is fraught with many difficulties, to overcome which, at the request of the Rhodesian Tobacco Co-operative Society, the Government Tobacco Expert has acted as supervisor of the warehouse until such time as it may be possible to arrange for the appointment of a competent leaf expert in the warehouse. A satisfactory system of handling the leaf from the tobacco barn to the manufactory is gradually being evolved; the process is undoubtedly a somewhat tedious and laborious one, but the results aimed at fully justify the pains being taken.

Cotton.—In regard to cotton, the position is that whilst this crop has been shown to grow well in certain regions and to prove of value in rotation with maize, no market has been found for it, in spite of the favourable reports by Home experts upon it.

Two years ago experiments on a fairly large scale, involving over 700 acres, were carried out, and two gins and a cotton press, supplied by the British Cotton Growers' Association, were erected by the Farmers' Co-operative Society in Salisbury, with help from the British South Africa Company. In regard to this costly and extensive experiment, the Cotton Expert reports as follows: "The whole of the experimental 1919-20 crop was sold locally at 6d. per pound for industrial purposes. At this price cotton is not a profitable crop. The price of middling cotton in Liverpool at the time the cotton was sold locally was approximately 11d. per pound. From this it would appear that the local sales price was very bad, but such was not the case. The press which was supplied by the British Cotton Growers' Association would only bale cotton to a density of six pounds per cubic foot. At that time ocean freight was 60s. per ton of 40 cubic feet, which would have been 3d. per pound for cotton baled at the above density. The railage to Beira is $\frac{1}{2}$ d. per pound, or £2 1s. 7d. per ton. In addition, there would have been insurance, commission, dock dues, storage, etc., so that the local price was practically equal to the price landed in Liverpool. The only cotton compress in the Union is at Durban. The railage from Salisbury to Durban is £6 5s. 3d. per ton, or $\frac{3}{4}$ d. per pound. In addition, there would have been the cartage to and from the compress, the compress charges, and the freight, insurance and other charges in addition. Until such time as proper facilities exist for handling the crop and transporting it economically, cotton cannot be grown at a profit. On account of the low price of maize, many farmers desired to plant cotton during 1921-22 season, but they were discouraged on account of the difficulty in marketing the crop."

This difficulty in disposing of the crop must have an adverse effect upon our efforts to meet the urgent demands of the Mother Country

made through responsible and representative channels. The future of cotton production has been discouraged, as without some assurance of markets, farmers are rightly chary of embarking upon the hazards of growing a novel crop.

Citrus.—The hopes raised and faith manifested in oranges are now amply justified so far as concerns yield and quality of fruit from orchards established a few years ago, and the possibilities of the country in this direction have now been demonstrated, except that the limit of suitable land has by no means yet been ascertained, and there are undoubtedly great possibilities of further expansion. There are, however, anxieties and difficulties in the development of the industry arising not from natural causes, but connected with questions of markets, export, transport, handling and management. The precise lines for future development have yet to be fixed; whether citrus culture will form a separate undertaking or a branch of mixed farming, whether it is best worked by companies or individuals, and in the latter case as large or small holdings, and how far co-operative selling is feasible. However these and kindred questions may ultimately be settled, there is happily now no doubt as to the suitability and bright prospects for this class of fruit in Southern Rhodesia.

Mention should be made in connection with this industry of the official visit paid by the Citrus Expert, Mr. Turner, to California, to study the latest developments there and to refresh his knowledge of that country. His principal observations have been published for general information, and the results are calculated to be of value to Southern Rhodesia. Much permanent benefit results from visits of this nature by technical officers with a knowledge of the needs of this country who can gather and bring back fresh ideas for communication to our farmers. Mr. Turner also examined market conditions in England and the question of ocean transport.

The 1921 crop exported amounted to 18,000 boxes, as against 9,175 in the previous year. About 4,000 boxes more might have been despatched had there been sufficient accommodation on ships. These consignments suffered somewhat from delays at the port, but realised prices in England up to 40s. in some instances, though also as low as 13s. per case. On this matter the Citrus Adviser reports as follows: "The average gross sales in England were about 23s., leaving approximately 13s. 6d. net Rhodesia, after deducting cost of box, railage, freight, dock dues, commission, etc., which is very satisfactory. The actual net profit to the grower, after deducting cost of growing, picking, packing and hauling to station, is, of course, dependent on the individual management, but should be around 10s. per box. On the basis of only one box per tree, this gives a profit per acre of about £40, according to the number of trees planted per acre. I may say that a well-cared-for orange tree of five years old can produce one first-grade box of oranges, while a similar tree increases its yield as it grows older, and by ten years is capable of producing three to four boxes. The annual cost of attention to ten-year-old trees is only slightly higher than to five-year-old trees, accounted for by larger fertiliser requirements. I would say that the position of the Rhodesian orange grower

is very favourable as compared with the Californian grower, whose net returns during six years prior to 1920 have been estimated at 90 dollars per acre, or about £18. Our more favourable position is mainly due to our cheaper land, water, labour and transport."

Citrus growers throughout South Africa have been discussing the formation of a Fruit Growers' Exchange on the lines of similar institutions which are very successful in the United States of America, and considerable progress was made in the preliminary steps to this end. The Citrus Adviser attended several meetings at Johannesburg and Capetown in connection with this movement, in regard to which he makes the following comments: "In my annual report for 1919 I pointed out that some citrus growers and prospective planters were sceptical of the future on account of shipping and other difficulties. I feel satisfied, now the Fruit Growers' Exchange has been launched, that if all growers will loyally pull together the future of the industry is assured. Since the Fruit Growers' Exchange commenced operations during the latter part of 1921, although late in the field for the season's shipments, shipping facilities have improved, and shipping companies now realise that they have a definite body with whom to deal, instead of disorganised groups of growers. As the Exchange becomes more thoroughly established, so will its channels of usefulness be extended."

Agricultural Research.—Perhaps the most important functions of the Department of Agriculture, of greater potential and ultimate value than the advisory, educative, administrative and legislative portions of the work, are those connected with scientific research, the study of new problems, and the acquisition of fresh knowledge on which all further progress and development depend. Investigations are in progress in such very varied spheres as arable farming, including crops, cropping, tillage and manurial treatment; chemistry, entomology, forestry and hydrology.

The various branches of the Department freely devote themselves, so far as means and other calls on their time allow, to research work, but there is room for much more to be done in this direction. There is yet need for experimental work to be undertaken in connection with stock raising in all its branches, irrigation, fruit, tobacco, dairying and mycology. From time to time the lack of opportunities for such study is sharply brought home.

Research.—Botany, a science so fundamental and helpful to agriculture, cannot receive that attention which is desirable, but an advance has been made in the determination, classification and study of the feeding value of our most important grasses; a new parasite has been recognised on cowpeas, and efforts have been made to educate the public in regard to certain weeds, notably the Mexican marigold. Diseases of crops, and especially of citrus fruits, tobacco and maize, demand more attention than we have as yet been able to give them, the angular leaf spot and wildfire disease of tobacco and anthracnose on oranges having of late emphasised the losses which are occasioned by such means.

Experiment Farms.—The policy of conducting experiments with a view to increasing the number of crops grown in the country and

improving our methods of handling them, and of treating the land, has been continued, and certain important developments have taken place during the year. The results attained and lessons drawn from them are widely made public through the *Agricultural Journal*, the press, by lectures, demonstrations, conversation and correspondence, and it is therefore unnecessary here to enlarge in any detailed manner on the results achieved.

The investigations conducted at the agricultural experiment station at Salisbury, which are essentially of a research character, have been attended with conspicuous success, and are becoming well known to the farming community, who visit the place in ever-increasing numbers. At this station many of the crops now common in the country were grown for the first time. From these initial introductions acclimatised seed has been issued for further experiment throughout the country. Such trials of new crops are still being continued, as well as important investigations in regard to rotation and the effects of previous crops on subsequent ones, green manuring and trials of foreign and native pasture plants and grasses. As indicating the scale and nature of operations, it may be mentioned that over 500 experimental sowings were made last season. Whilst the methods followed involved no treatment other than what may be regarded as good farming practice, the average yield of all the maize plots throughout the station came to 21 bags per acre, showing that the methods adopted maintain and enhance the fertility of the land. Amongst the outstanding features of interest this year may be mentioned the propagation of the new perennial fodder plant, kudzu, and the success attending the isolation and propagation of native grasses for hay and pasture.

The Gwebi experiment farm has served a very useful purpose, and has proved particularly instructive to those farming on our red soils. The results of observations at Salisbury are here repeated on a field scale, while other experiments are conducted which space does not permit of on the smaller station at Salisbury. Seed is also grown in large quantities for distribution to farmers for experimental purposes throughout the country. The farm is now in a high state of cultivation, and the results of cropping have been very satisfactory. There is still room for extending the usefulness of the farm and for improvements, involving, however, expenditure on buildings and live stock.

A series of feeding experiments have during the past few years been carried on. These have determined the main lines for economical stall-fattening of oxen with foodstuffs entirely produced on the farm. The methods devised are being adopted and followed by a number of farmers, and may be regarded as furnishing the basis on which a large business in fattening in the arable farming districts store cattle bred on the ranches may be built up as soon as dependable outlets for prime fat stock can be secured.

The buildings at Gwebi remain in their very incomplete unfinished state, and provide inadequate accommodation for the staff, or for stud cattle, pigs or a dairy herd, if and when these should be provided.

The income derived from the farm was £1,929, as against £2,654 last year, a difference in large measure due to fall in prices. Such an

experiment station is, however, not expected to pay its way, since the real return lies in the information gained; and necessarily in ascertaining the means of getting the best results, many light crops and some failures have to be encountered.

It has long been a matter of regret that there has been no sand veld experiment farm. This deficiency was to some extent made good by the liberal provision of certain facilities on a few acres of land on his sand veld farm, Arlington, some eight miles from Salisbury, by Sir Harry Waechter, who undertook to defray all expenses in connection with such a station, to be conducted under the direction of the technical officers of the Department of Agriculture, the resulting crops naturally belonging to the farm. After much preliminary work, some promising experiments have been initiated, but of course it necessarily requires several years for such a station to attain to its full value and for its purpose to be appreciated by the public. A full report on these experiments to date has been published. In default of an adequate Government experiment station for the sand veld, this work at Arlington is the best substitute that can be provided.

During the year an arrangement was made between the Government and the Municipality of Bulawayo, whereby a suitable site, including some 20 acres of red loamy soil, characteristic of the neighbourhood, was set aside as an agricultural experiment station at the old Hussar camp, about two miles from the centre of the town. The Government has supplied seed and fertilisers, and has organised and generally supervised the experiments and the actual cultural operations. All the necessary labour and local control has been provided by the town, and the Municipal Council is taking a very kind and helpful interest in this matter, which it is hoped will be of benefit to farmers in that vicinity.

A series of experiments with fodder crops and with rotations are also in progress at Ingutsheni, in the same vicinity, under the care of Mr. McLean.

At Makwiro, on Mr. Smith's farm Cromdale, experiments are being continued under the supervision of the experts of the Department, consisting primarily of manurial and cultural experiments on soils which have been found in the past difficult to crop successfully.

At Shamva, on Mr. A. R. Morkel's farm Ceres, an experiment has been laid out on 100 acres of land for the purpose of demonstrating the effects of systematic rotation. The influence of this practical test, carried out in the centre of the maize belt by the president of the Maize Growers' Association, should have a far-reaching influence on our maize farmers.

An interesting series of experiments is being conducted by Mr. H. B. Christian, of Ewanrigg, Enterprise, in soil treatment and green manuring, the results of which he is keeping before the farmers in order that they may benefit by his investigations.

In co-operation with Mr. P. H. Gresson, of Sebastopol, Salisbury, an enquiry was initiated by the Department in the cultivation of a number of imported and local varieties of rice, the final results of which

cannot be attained for several seasons, but which, when they are concluded, will, it is anticipated, lead to the cultivation of this valuable crop on a large scale. At present the chief object is to find varieties which by their even-ripening and non-shedding characteristics will render possible harvesting by machinery, and will thus mature sufficiently early to avoid the effects of the cold season following on our rains.

The production of barley for malting purposes has been actively taken up in conjunction with the South African Breweries, who have arranged for a large number of experiments in what is likely to prove favourable districts in Rhodesia. So far, conflicting results have been obtained; some very fine crops of excellent quality have been raised, whilst, on the other hand, several complete failures have been reported, difficulties not unusual in experiments of this sort. By continuance of these experiments it is hoped to ascertain definitely where and in what regions malting barley can be profitably produced in this country, either on wet vleis or under irrigation.

From these brief references it will be realised that crop experiments are being actively pursued in many parts of the country, but it must be admitted that this work could be actively extended with very considerable advantage by the establishment in different parts of the country of small farms or stations entirely devoted to experimental work, and intended to serve as demonstration stations for local farmers. The success attending our efforts under unfavourable conditions fully warrants the hope that in time such a series of Government experiment stations will be established.

Chemistry.—The work of the chemistry branch naturally divides itself under two general heads: routine work and research. Under the former category are included chemical examinations and advice to farmers in their ordinary work, control of the composition of fertilisers and farm foods in accordance with the law relating thereto, the examination of cattle dips and toxicological analyses for the Veterinary Department. In regard to the last-mentioned item, it is interesting to note that out of 108 examinations, in 47 death was found to be due to arsenical poison. This heavy loss, attributable to the freedom with which arsenic is used for dipping purposes, might be largely avoided if more care were exercised in handling these dangerous preparations. In this connection the Chief Chemist states: "In the course of the routine work of the chemical laboratory it has frequently been found that a sample submitted for toxicological examination contains an appreciable quantity of arsenic, but not sufficient to warrant a definite deduction that death was due to arsenical poisoning, consequently an investigation was carried out during the year to determine the amount of arsenic which may be present in the stomach content of healthy, regularly dipped cattle. Arrangements were made for samples to be taken from regularly dipped cattle which had been slaughtered at the local abattoirs, and we now know from the examination of those samples that amounts corresponding to 0.05 gm. of arsenious oxide may be present in 60 gm. portions (containing 50 per cent. each of walls and contents) of the first and fourth stomachs of healthy animals. The results of

that enquiry are not only very interesting, but also of value, in that they enable the analyst to deduce whether arsenical poisoning was the probable cause of death in suspected cases of poisoning."

Chemical research is being pressed on as and when opportunity serves, the number of subjects at present receiving attention including problems connected with green manuring, pot culture experiments in connection with magnesia soils, manurial trials with maize, investigations of limestones and travertines, and the composition of grasses. Good progress has been made in these directions, but other pressing questions still await investigation.

A classified list of the samples analysed during the year is presented in the following table:—

Soils	69
Fertilisers	22
Cattle dipping fluids .. .	240
Toxicological analyses .. .	155
Limes	12
Vegetable products	46
Waters	8
Dairy products	8
Miscellaneous	14

574

Under this heading it may be mentioned that the high prices of fertilisers still militate against their general use, particularly in view of the low price of crops upon which they are used. It is interesting to record an increased number of South African firms manufacturing fertilisers on a large scale to meet local demands.

Entomology.—The study of injurious insects has received considerable impetus through increase of staff, and this work has been actively pursued. Insect pests calling particularly for attention have been the black maize beetle, which has caused considerable alarm in the Midlands, maize snout beetles, pests of stored grain and of citrus fruit, the latter being a field in which much is to be gained by systematic preventive and curative measures. Attention has also been given to the life history and control of fruit-piercing moth, bean stem weevil, bean leaf weevil, cabbage web worm, cabbage aphides, tobacco wire worms and other insects.

In regard to tsetse fly, extension of the region occupied by this very serious pest has been noted in several directions, but happily it has withdrawn from our eastern border. The experiment conducted in the Wankie district has been continued for the third year with a very marked diminution of the tsetse following on the systematic discouragement of game in a defined region. The results of this work appear reasonably conclusive, and whilst complete elimination of either is hardly practicable in the circumstances, there is every reason to believe that the amount of fly is directly proportionate to the quantity of game, and that the reduction of wild animals is a necessary precedent to the occupation of unoccupied country at present inhabited

by tsetse. The disappearance of the game, coupled with the taming of the country consequent on occupation, may be relied on to lead also to the disappearance of fly. From this it appears that it will suffice to take measures to discourage game in order to protect the already occupied parts of the country which lie in potential fly areas, and to permit of the gradual extension, as circumstances require, of the settlement into regions at present unfit for occupation either by cattle or man on this account.

Forestry.—A lively interest is being manifested in the possibility of tree planting and in the value of the natural forests of Rhodesia, and there is a great demand amongst farmers for eucalypts and other trees in order to establish plantations, as well as for ornamental trees and shrubs wherewith to adorn their homes.

The work of the forest nursery continues to expand, and good progress has been made during the past year. The recently appointed forest officer has necessarily devoted considerable time to the study of forestal conditions in the Territory, and in the collection of data in regard to our trees and their distribution, growth, habit and timber value. The forests on parts of the unalienated land have received attention with a view to determining their possibilities and to ascertain what are the characteristics of our natural bush as a whole, and of our various native timbers. In this way valuable observations are being made in a hitherto almost untouched domain, with a view to future development when opportunity serves.

Irrigation.—Although favoured with a summer rainfall rendering it possible successfully to crop dry land, Southern Rhodesia yet affords considerable scope for the successful development of irrigation, especially with a view to rendering close settlement profitable, and to turn to the greatest use rich alluvial valleys commanded by reliable streams. The services of the irrigation branch of the Department have for some years been largely devoted to laying out schemes for farmers, and in all 32,598 acres of irrigable land have in this way been found, and in many instances details of the necessary construction works have been prepared. Of this land about half lies in the Mazoe district, the other principal areas being in the districts of Gwelo, Selukwe, Umtali and Victoria. Other work connected with development of the water supply consisted in the services of the Irrigation Engineer as assessor on water courts, and in boring to increase the supplies on the native reserves, as well as a considerable amount of advisory work to individual farmers.

Hydrology.—The annual meteorological report is issued separately; suffice it here to say that so far as funds will allow, equipment has been improved and the system of collection and record of data developed, maps prepared and the work brought well up to date. Hydrographic research, though still in its rudimentary stages, has made considerable progress, and data of the utmost importance in relation to river gaugings, run-off, evaporation and the duty of water have been collected. A preliminary report on the water power resources of Rhodesia was prepared specially for the Imperial Power Conference, and has been

published for local information. In the administration of the Water Ordinance since the commencement, water rights to the number of 116 have now been given, affecting 16,402 acres of irrigable land, mainly by means of diversion works to utilise the available normal flow without much storage provision. The operations of the water courts appointed under the Water Laws have expanded very rapidly during 1921; the value of water and the need of a definition of rights in relation thereto are now very generally appreciated.

Statistics.—The collection of statistics, the value of which is now fully recognised, forms an important portion of the duties of the Department. The information so collected is in constant request for a great variety of useful purposes, whilst the records extending back now over seven years show conclusively the progress attained in every branch of the farming industry and for every district in the country. The system runs smoothly, and has won the confidence and willing support of the farmers. The data furnished in this report are mainly derived from this source.

"Rhodesia Agricultural Journal."—The official journal, issued every two months to the number of 1,800 copies, is much appreciated by those for whose benefit it is more particularly issued. It provides a large amount of original matter of an informative kind, and contains all the latest results of enquiries and investigations by the experts of the Department. There is a constant demand for reprints of special articles in bulletin form.

Pounds.—The number of pounds stands at 50, six having been established and one abolished. The working of the pound system requires revision.

Brands.—The brands registered numbered 379, bringing the total number to 8,057. Although there are obvious objections to placing upon the beast marks which damage the most valuable portion of the hide, yet there are strong practical reasons for continuing the practice and inadequate inducements to depart from it.

Vermin.—Losses by wild dog, leopard, snakes, lion and other vermin appear to be on the increase rather than otherwise, perhaps owing to extension of farms and ranches into more remote parts, and owing to the great increase of live stock. Wild pig and baboon continue to play havoc with maize crops. In organised hunts last year 437 of the latter were accounted for.

Departmental.—The Department as a whole continues to develop, though slowly, on account of bad times, increases in staff being demanded by the public, a sign that the services already rendered are appreciated. Two assistant entomologists and an assistant tobacco expert were appointed during the year, also two maize graders as permanent officers, whose time when not occupied in grading will be turned to useful account in agricultural experimental work.

Unfortunately, owing to financial restrictions in the matter of travelling, the number of personal visits paid by the staff to farmers has been somewhat less than usual. This service, which at first sight

may seem slow and trivial, has been found by experience to be far the most effective and lasting in its results, teaching the expert the different needs of all parts of the country and bringing home to the farmers the possibilities of improvement which cannot be secured by any other method of communication. Visits even at very long intervals are appreciated by both parties, and hints and lessons taken and given are remembered and turned to account to an extent no lectures, shows, books or letters can equal. Especially is this the case in a new country such as ours and with a population so largely composed of newcomers, many of them without any agricultural experience, but possessed of an eager desire to discuss their difficulties at first hand with those able to help them.

Acknowledgment is due of the manner in which all members of the staff have performed their duties, and of the spirit of collaboration amongst the branches as well as of co-operation with the farmers in advancing our agricultural welfare.

Advice upon Irrigation and Engineering Matters.

Farmers desiring the services of the Irrigation branch should make application to the Director of Agriculture, Salisbury, as set out in Government Notice No. 94, dated 27th February, 1920.

It might be pointed out that the work of this branch is now very heavy, and it is necessary that applications be made as early as possible so that the officers can arrange their tours to avoid unnecessary travelling and overlapping.

As the details of each tour are usually arranged some time ahead, it will in many cases not be possible to attend to verbal applications made to an officer upon his arrival in the district concerned.

Notes from the Entomological Branch.

By RUPERT W. JACK, F.E.S., Chief Entomologist.

I.—A NEWLY RECORDED PEST OF MAIZE: "ROOTWORM."

The following note is designed to direct attention to a pest of maize, recorded here for the first time, which appears at present to be of a sporadic nature, but may possibly prove of more importance in the future. Damage from this insect first came to light in December, 1918, and it was hoped to work out the life history and learn considerably more concerning its potentialities as a pest before publishing anything concerning it. Efforts directed towards elucidation of the life history have so far been fruitless, great difficulty having been encountered in obtaining material for breeding at the right time of the year, and complete failure in regard to obtaining sufficient quantities. It is hoped that the publication of these notes may, however, result in instances of injury being reported, which will facilitate the collection of material and further study. It is probable that damage to a limited extent occurs on most red soils planted to maize each year.

The appearance of a plant injured by this pest does not differ very markedly from that of plants attacked by several other pests, as, for instance, maize stalk borer, black maize beetle, and in some cases cutworm, *i.e.*, the centre of the plant withers and dies, leaving the outer leaves green. On pulling up such a plant, if the present pest is the cause of the trouble and the operator has not already left, a small yellow grub will be found partly, sometimes wholly, buried in the underground stem. This is the young or larval stage of a native leaf-eating beetle (*Apophyllia murina*, Gerst) and is figured on Plate I. The general coloration is that of very yellow butter, but the grub also bears a large number of dark brown spots, as in the illustration, whilst the head and last segment are chestnut brown. These little grubs do not exceed three-eighths of an inch in length, yet, owing to their method of attack, a single specimen commonly causes the death of the plant, if young enough, or so distorts it that the cobs produced are of very little value.

Very little is known concerning the life history and habits of the pest. The egg stage has not been observed. The larva or grub when full grown (*i.e.*, about three-eighths of an inch long) constructs a weak-walled chamber in the soil, about one quarter of an inch long, in which it changes to the pupal stage. The pupa is butter yellow like the larva and measures one-fifth of an inch or rather more in length. The

duration of the pupal stage has not been exactly noted, but some feeding larvæ collected in January gave rise to the first adult nineteen days later.

The adult beetle is a very unassuming little insect of the form shown on Plate I. Its colour is a uniform very dark grey, nearly black, and its size varies between one-sixth and nearly one-quarter of an inch in length. The bases of the antennæ and of the legs are chestnut brown; the head, thorax and wing covers are closely pitted or punctured and the latter bear a short and very fine, light-coloured pubescence or down.

The few scattered notes so far collected indicate that more than one brood occurs during the year, beetles having been bred out in January, February, March and April. The grubs have been found injurious in December and January, when the maize plants are young enough to suffer from their attacks. From the fact that practically full grown larvæ have been found attacking maize when it has not been above the surface more than a week or so, it is obvious that the eggs from which the grubs, which injure the maize, hatch are not necessarily laid on the crop itself. In point of fact, it is questionable whether the insect can perpetuate itself on maize alone, as grown in this Territory, the intervention of a succulent food-plant late in the season being perhaps necessary. The adult beetles will eat the leaves of maize and some other grasses, but it is uncertain whether such plants constitute their favourite diet. In the cages they proved exceedingly restless during the day and were very persistent in insinuating themselves into crevices which would in nature afford both concealment and protection. Whether this behaviour was the outcome of confinement or whether the beetles are more or less nocturnal in habit is not certain. Nocturnal habits are at least unusual in this family, but the supposition is to some extent supported by the fact that beetles taken in the field have not been seen until the grass (*Eleusine*) with which they have usually been associated has been raised, when the beetles have appeared running with considerable activity over the ground.

In addition to maize, the larvæ have been found very freely feeding in the underground stems of so-called "Rapoko grass" (*Eleusine indica*, Gaertn), and this is possibly an exceedingly important factor in connection with the outbreaks of the pest. Other grasses are, no doubt, attacked, and reports have been received from parties familiar with the pest to the effect that larvæ eat into the pods of ground nuts and attack the underground stems of tobacco. It is by no means unlikely that the pest has a wide range of food-plants, as an allied beetle of somewhat similar habits in the United States of America, namely, the so-called "Southern Corn Rootworm" (*Diabrotica 12-punctata*, Oliv.), is stated to be very catholic in its feeding tastes, and in addition to its attacks on maize is a pest of cucumbers and many other garden plants in both the beetle and larval stages.

The question of alternative food-plants is of prime importance. One farmer, who reported the attack of the larvæ on ground nuts, lost thirty acres of maize two consecutive years following the planting of the land to this crop. The writer visited the farm the second season of loss and examined the land in April. The crop of maize on this piece of land



Young maize plant killed by rootworm.



Young maize plant injured by rootworm and putting out a sucker



Wild Rapoko grass (*Eleusine indica*, Gaertn), a host of the maize rootworm.

was more or less an entire failure and the ground was covered mainly with a volunteer crop of ground nuts and Rapoko grass. A lengthy search failed to reveal any of the grubs in the ground nut pods, but quite a number of pods showed perforations of the correct size. A number of beetles were found, chiefly associated with the Rapoko grass, and one almost full grown larva was taken attacking the underground stem of this grass. Examination of the underground stems of the grass on the thirty acre block showed typical injury by the grubs in almost every instance, whilst a check inspection of the same grass on land where maize had not been injured gave negative results.

During the spring following these observations other outbreaks came under observation, and in most cases, but not all, they could be traced definitely to land which had been infested with Rapoko grass the previous season. There is thus considerable reason to think that this grass may have a very great influence on outbreaks of the pest, and that although not a particularly bad weed in itself, its development late in the season may render it of great value to the present pest after the maize stalks have become too hard for attack. The weed commonly thrives very well on suitable soils after the usual method of cultivation has become impossible, and direct effort to keep it down may be profitable on such lands.

The question of the influence of ground nuts in favouring increase of the pest calls for further investigation. The writer has not yet witnessed actual attack on this crop, and the same remark applies to attack on tobacco.

A few more words are necessary concerning the damage caused by this pest. There are definite reports to the effect that the germinating seed may be attacked and destroyed in the soil, an obscure form of injury which would in general escape notice. Many young plants are killed outright by the larvæ boring into the heart. It may be mentioned that more than one larva sometimes attack a single plant, but the writer has not observed more than two. Stronger plants or those that are less severely injured frequently send up "suckers" from below the point of injury, and a very distorted plant, frequently with two stems, results, the cobs being of almost negligible value. (See illustrations.)

The pest has apparently certain preferences in regard to soil. One of the worst sufferers from its ravages in the Mazoe Valley states that it chiefly attacks maize on the lighter soils, rarely on the chocolate and never on the black. All attacks witnessed by the writer have been on red or yellow soils, but the possibility of its proving a pest on heavier lands is not excluded.

The following is a short history of the pest in Southern Rhodesia according to the very incomplete records of this office. It should be mentioned that the damage brought to the notice of the Department probably represents only a very small fraction of the damage actually sustained.

The first account of damage, accompanied by specimens of the insect and the injured maize plants, was received in December, 1918, from a

farm at Concession, Mazoe; four days later similar damage was described to the writer by a farmer at Enterprise, and in January, 1919, a considerable number of plants were found to be attacked in the grounds of the agricultural laboratories at Salisbury. During the same month maize on farms close to Salisbury was found to show widespread, but not intensive, damage, the loss in one case being estimated at 5 per cent. or more. Complaints at this time were also received from various parts of the Mazoe Valley, many of them through indirect channels, and the information was elicited that the pest had been in evidence on some farms the previous season, in one case, as already mentioned, thirty acres of maize having been almost completely demolished in two consecutive seasons, in addition to more distributed injury. In December, 1919, some plots planted in connection with manurial trials at the Gwebi experiment station suffered severely. Some of the plots, of which there were a considerable number, each covering one acre of ground, lost outright as much as 50 per cent. of the plants, not counting those which were merely injured. In the 1920-21 seasons, with the exception of a reported attack on tobacco, nothing was heard of the pest, nor have complaints been received during the past season, but on one farm at Concession the insect was stated to have been in evidence in 1921 to a slight extent and all the originally infested lands had been thrown out on account of the pest.

It is quite obvious from the above that this insect may cause severe injury. The one farmer who lost 30 acres two years in succession had a palpable shortage of some £300 in his income for the two years, and although difficult to estimate, the more scattered injury probably amounted to as much again from this pest alone. Such losses may be preventable, and in the general interest farmers who observe this pest on their lands would do well to bring the fact promptly to the notice of the Department so that field observations may be made and material collected for study at the agricultural laboratories.

The writer has applied the term "*Rootworm*" to this insect on account of the similarity of its habits to the Southern Corn Rootworm (*Diabrotica 12-punctata*, Oliv.) of the United States of America, which belongs to the same family of beetles, namely, the *Chrysomelidae*. It is true that it has not yet been found to feed on the roots of the plants, but from the recorded habits of its relation across the Atlantic, it no doubt attacks this portion of the plant as well as the underground stem.

II.—ANOTHER NEWLY RECORDED PEST: "PINK GRUB."

In January, 1913, a complaint was received from the Hartley district concerning the ravages of a small pink "caterpillar" amongst kaffir corn, the damage being stated to consist in the insect eating into the underground stem and germinating seed of the plant. Some fifteen acres had had to be replanted. Specimens forwarded proved the "caterpillar" to be the larva or grub of an unknown beetle.

During the same month the same insect was discovered injuring kaffir corn at the experiment plots, Salisbury, over 50 per cent. of the plants being destroyed. From material collected around these plants, the adult beetles were bred out in late March and early April, and



Result of rootworm attack. Maize plant produced by two lateral suckers, stunted and producing cobs of little value.

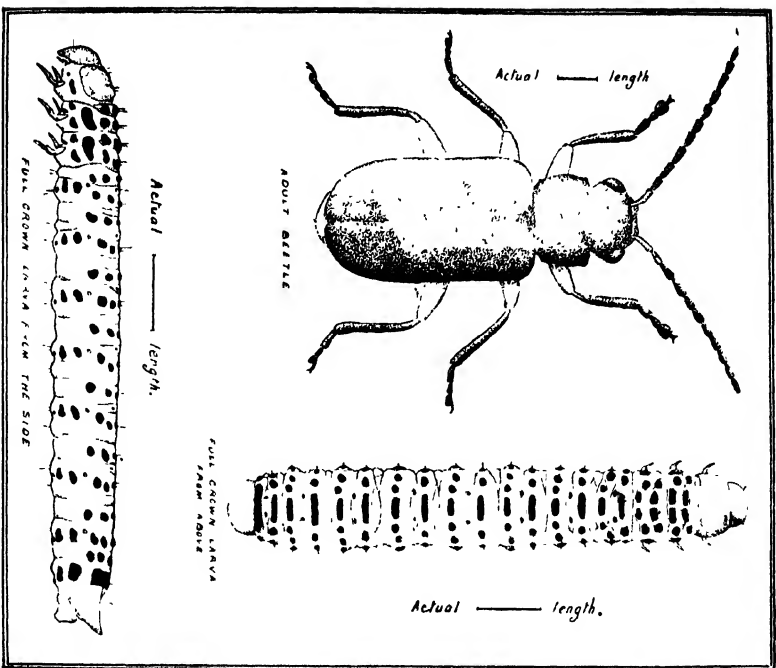


Plate I. Maize rootworm

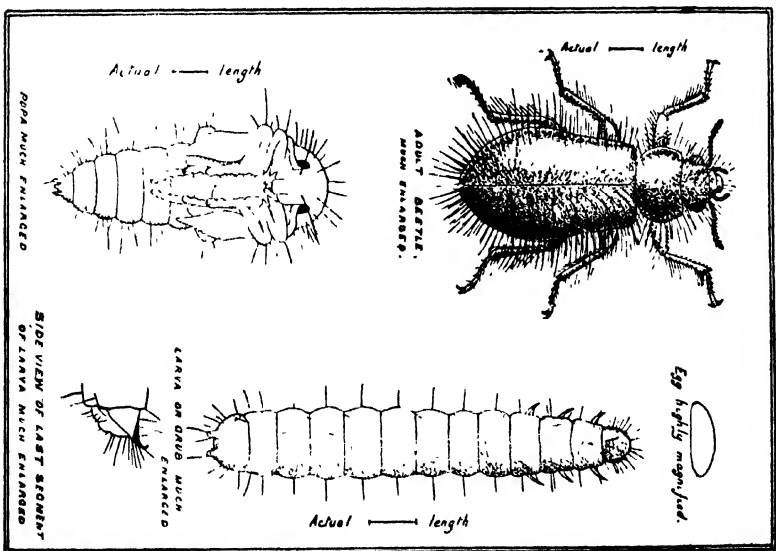


Plate II. Pink grub.

during the latter month many of the beetles were collected in the field. Specimens were forwarded to Dr. Peringuey, of the South African Museum, for identification. This entomologist replied that the beetles belonged not only to an undescribed species, but to a new genus which would probably fall into the family *Melyridæ*. The beetle remains undescribed to the present day, and can only, therefore, be referred to under a popular name, such as "Pink grub," which applies to the larva.

The adult beetle is small, dark brown, very hairy, and does not exceed one-fifth of an inch in length. Its general appearance is shown on Plate II. The beetles are commonly very abundant on the heads of Natal red-topped grass (*Tricholana rosea*, Lees) and of teff grass in April and May, where they apparently feed chiefly, if not exclusively, on the pollen.

Beetles collected at this time of the year have laid their eggs loosely in the soil in cages in the laboratory. The egg is yellowish, elongate, shiny, and measures some .68 mm. x .22 mm. (mm. signifies millimetre, equal to about 1-25th inch). From these eggs the coral pink grub hatches out, and when full grown measures about 7 mm. in length and is of the form shown in the plate. It then constructs a small chamber in the soil, where it changes to the pupa stage (see plate), from which the adult emerges later.

The complete life history has not yet been followed, nor is it known for certain how the insect passes the dry winter months. From the fact that eggs are laid freely in April and May and that these hatch in May and June it is probable that the winter is passed as a larva or grub in the soil. What it can find to feed upon during this period of dearth is a puzzle, but there is a possibility, from the habits of allied forms, that the grubs are in part predaceous, feeding on other insects. Whether the grubs from this autumn brood are those which are injurious to crops in December and January, or whether another brood occurs in the early spring, is uncertain at present, but probability appears to be in favour of only one brood during the year.

The feeding habits of the grubs as far as they have been noted are very similar to those of the "rootworm" (*Apophyllia murina*, Gerst). They eat into the underground stems of young kaffir corn plants and destroy the heart, so that the centre of the plant withers. They will also injure maize in the same way, but do not seem able to penetrate the more vigorously growing stems as successfully as the "rootworm," and although damage to the crop has been both noted and reported, it has not as yet compared with the devastation caused by the "rootworm" when present in numbers. Further observations are, however, needed under this head. Apart from the more conspicuous attack on the stem, the grubs eat the young roots and also exhibit a liking for the germinating seed, whether of sorghum or maize. If the grubs are plentiful, much obscure damage may be done to the maize crop in this way. This is only one instance of the subterranean activities of insects, which undoubtedly cause more damage than is generally recognised and contribute to the general imperfect stands and uneven growth of maize to which attention is continually being directed.

The pink grub is, however, not confined to plants of the grass family for its food supply. It has been found at the roots of peas, beans, cowpeas, etc., and has been reported as destructive at least to peas. It is not quite clear whether the insect normally injures this class of plant to any great extent, but in one instance a grub was found entirely buried in the stem of an unhealthy cowpea plant, which was, however, also infested with the bean stem maggot (*Agromyza* sp.).

From the partiality of the beetles for the tops of Natal red-topped and teff grass, it is highly probable that the occurrence of either has a direct effect on infestation of the soil with the grubs. This effect in the following season is obvious if the insect proves to be single-brooded. If a brood of beetles occurs in the early spring, they would presumably seek food elsewhere, as the grasses mentioned are not then in flower; indeed it is doubtful what the beetles could find to feed upon of the same nature at that time. The intervention of a spring brood is, however, somewhat improbable. All the beetles in the collection have been taken or bred out in March, April and May. Larvæ taken early in January did not yield adults before late March, so that the development is certainly not as rapid in the case of the "rootworm," which almost certainly has more than one brood during the year.

Attempts are at present being made to follow the life history and habits of this insect more closely under cage conditions.

GENERAL REMARKS.

The purpose of the foregoing notes includes, besides the desire to place on record the injurious habits of the beetles, and to call the attention of farmers to their activities in this respect, a more general motive in emphasising the complicated nature of the influences which affect the cultivation of crops in this territory as elsewhere. The development of Rapoko grass amongst the maize crop late in the season is in general regarded with equanimity by the grower, and yet its presence may be the determining factor in regard to whether he is to reap a good or poor crop off that piece of land next season. The same remark may apply to patches of Natal red-topped and other grasses in the lands, not to speak of weeds belonging to other families. Not all the insects which vex the farmer are encouraged by lack of cleanliness in the lands, but a great many are, and it may be regarded as an axiom that the cleaner the farming the less liability to loss from pests, and this applies both to conspicuous injury of which the grower cannot but be aware, and to obscure attack of which he is usually ignorant. The hidden insect in the soil which destroys the seed or the plant and before it appears above the surface causes the same loss as the stalk borer, cutworm or beetle which destroys the plant during growth. The fact that a 75 per cent. to 80 per cent. stand is regarded as decidedly good on Southern Rhodesian maize farms speaks for itself, and it cannot too often be repeated that in growing maize with an average of plants between 60 per cent. to 70 per cent. of a perfect stand, we cannot expect to compete in the world's markets and reap a reasonable profit. The moral from the entomological, in addition to other standpoints, is that maize culture must gradually move in the direction of more intensive

methods, under which the soil can be better worked and better cleaned, whilst measures for reducing loss from insect attack are rendered more practicable. Smaller acreages, better stands, and bigger yields per acre are the ideals to aim at, and as we move in this direction the cost of production per bag will be correspondingly reduced. Whilst, of course, it is not profitable for a farmer to grow crops under the methods employed at a Government experiment station, the comparative immunity from many insect pests which crops enjoy when grown under such ideal conditions is an indication of what may be expected from more intensive and cleaner methods of culture.

We have a very great deal to learn concerning the toll which insects levy on the maize crop in this territory, and as our investigations proceed we shall no doubt be able to indicate more definitely the effect likely to be produced by the prevalence of different weeds, by various methods of maintaining the fertility of the soil, and by various rotations, but it is perfectly clear as a general statement that in this as in all other countries, the cleaner the farming the less liable the crops are to be destroyed or reduced by insect attack.

White *versus* Yellow Maize.

The following very interesting information has been received in a letter dated 20th April, 1922, from Messrs. R. & W. Paul, Ltd., Ipswich.

"I fully agree that the large White Flat as exported from Rhodesia is not only the best South African maize, but probably the best in the whole world. The reason why the Rhodesian white maize has sold so badly this year, compared with other maize, is because there is only a limited demand for white maize *at a premium* over other kinds for special purposes which, however, are definitely limited; consequently as soon as there is more white maize than is required for these special purposes the selling value necessarily drops, as for other purposes yellow maize is preferred (I think unreasonably so) and invariably commands the premium.

"There is no doubt that for distilling and certain other manufacturing purposes a limited quantity of white maize will always

command a premium, but as soon as that demand is filled the market will be over-loaded and a discount rather than a premium will be the result.

"Quite a considerable portion of the maize trade in the United Kingdom and the west of Europe is for round maize for poultry food, for which there is a steady and increasing demand, the buyers *insisting on having only round maize of the La Plata type*. While there is a bountiful supply of La Plata it sells at or about the price of other maize, but sometimes, as recently, when the quantity of La Plata is not sufficient to meet the demand for the poultry feeders, La Plata maize for this purpose will sell at very large premiums. For instance, La Plata maize recently has been selling at practically 10s. per quarter over other maize, either yellow or white, and as much as 6s. per quarter over No. 6 Round Yellow South African, which is somewhat of the same type and only slightly bigger in kernel, but which is not considered generally sufficiently small to replace La Plata, even at a discount of 5s. or 6s. per quarter.

"You state in your letter that American maize, as well as La Plata, is frequently quoted at a higher figure than South African. This, however, I do not think is often the case, as white South African, as far as my memory serves me, has almost always fetched at least as much as American and often is worth a premium over it.

"It is difficult to give an opinion as to the best policy for your farmers, especially as you state in your letter that your climate is unsuitable for round yellow maize. I think, however, on an average of years it would be safest to grow somewhere about half white flat and half yellow flat."

The Chief Agriculturist and Botanist, in replying to Messrs. R. & W. Paul, Ltd., gives the following reasons why, without detriment to the maize growing industry as a whole, the recommendation to divide production between yellows and whites cannot well be put into effect:—

"Your views confirm those which have been expressed in other quarters, but our difficulty is that we cannot encourage the production of the small round yellow flint varieties in this Territory. These small flints give a very much lighter yield per acre than do the dent varieties. The premium which they command would not compensate for the reduced yield.

"We could grow yellow dents, but as far as I am able to judge it is the yellow flints which command a premium and not the yellow dents. On the other hand, our indigenous natives do not eat yellow maize meal; and as you are no doubt aware, if we were to endeavour to grow both the yellow and the white varieties in the country—yellows for export and whites for local consumption—we should very soon have excessive hybridisation taking place. This would mean that our maize would be mixed, *i.e.*, neither white nor yellow, but the two intermingled. I take it that such grain would then fall into the same category as 'mixed American,' which of late has been at a discount as compared with South African or Rhodesian whites."

Velvet Beans.

In the article on this crop which was published in the February issue of the *Journal*, Mr. Walters, the author, commented on the origin of the white stingless variety which has now become so popular in Rhodesia, and which seems to be identical with or at least very similar to one of the best American varieties. It was pointed out that the original seed of our white stingless variety was obtained from native Rhodesian sources. In this connection the following report from Mr. W. Edwards, Native Commissioner, Mrewa, in reference to a sample of white velvet beans recently sent by him to the Department, is of interest:—

“I have just returned from Fungwi, where these beans are grown by the natives for human consumption. When I was down last, many of the plants were in flower, and some of them had pods formed. All the flowers I saw were white, but the natives inform me that some of the plants have mauve flowers, but that white is the more common.

“These beans have been grown by the natives in Fungwi and Maramba since the year one, so far as I can ascertain; anyhow, they have always grown them, and I remember sending some seed to Salisbury over twenty years ago, but I cannot find the notes I made about them in any of my old notebooks.

“To prepare for eating:—The beans are put in a pot with water and allowed to simmer by the fire all night; next morning the outer husk of the bean is rubbed off and the beans again put on to cook. The water must be changed at least three times, otherwise the beans contain a poison which causes bad stomach trouble. The natives say this food is very satisfying, and very little goes a long way. I am sending you some of the beans in the pod, both green and dry, also a few pressed leaves of the plant, just to make sure we have got the right thing. I do not know if they will grow as well on the high veld as they do in Fungwi, which is only 2,000 ft. They grow up old tree stumps 20 ft. high, and twine round the kaffir corn and munga stalks in great masses of foliage.”

Last year a sample of greyish white velvet bean seed was received from Captain J. M. Moubray, of Chipoli, Shamva, with the information that this variety was grown by the natives in his district. These seeds were sown on the Salisbury experiment station this season, and the variety proves to be quite new and apparently an intermediate form between the common Florida velvet bean and the wild Buffalo bean (*Mucuna coriacea*) native to Rhodesia. Captain Moubray's variety has pods covered with a dense clothing of yellow hairs, longer and more irritating than those of the Florida bean, but not so long or irritating as those of the Buffalo bean.

The variety now sent in by Mr. Edwards seems to be again different to anything we have at present. In general characteristics it closely resembles the white stingless kind, but the seeds are very much smaller, and as far as can at present be judged more seeds are contained in each pod.

The fact that native, or at any rate long introduced, varieties of the velvet bean have for many years been known to the natives of the warmer and more remote districts of the Territory is an ample explanation of the outstanding success which this crop meets with when brought under European methods of cultivation.

H. G. M.

The Flaying, Curing and Drying of Hides.

By R. R. NEEDHAM, Manager, Rhodesia Leather Co., Ltd.

Flaying.—In the removal of the hide from the beast every care must be taken to avoid cuts in the skin, special care being observed at the tail end and the bellies, where knife incisions are more likely to occur. The former is centred about the most valuable part of the hide from the leather aspect, and rather than run the risk of cuts, it is better to leave a little meat on the skin. The removal of the belly portions can be aided by punching or the use of a stick, so as to limit as much as possible knife work. A hide should not be dragged along the ground hair down.

Curing.—After draining the hide for an hour or two, it should be spread out on a floor in the shade, flesh uppermost, and well covered with dry salt, care being taken that the edges are adequately salted. If other hides are to be cured, the second skin should be spread hair down on the first one, again the flesh well salted, and so on until a pack is built up. Each pack should remain in salt from seven to ten days, except for hides being sent to this company's tannery, in which case three days are sufficient. During the curing period it is advisable to shift the packs once or twice, that is, to make the top hide of a pack

the bottom one of a re-made pile, and therefore the bottom one of the first becomes the top of the second. Care should be taken to retain the salt on the hide, and, where deemed advisable, a little more should be added, always having the edges well protected. In the case of single hides, cure over same period, adding a little more salt after (say) three days.

When curing is completed the salt can be brushed off the hides (or hide) as they are removed from the pile, and this salt again used in combination with clean material for other packs.

It will be found in practice that the salt consumption is not so considerable as may appear from the foregoing instructions.

A brine bath can, of course, be used in lieu of dry-salting, but we recommend the latter.

Drying.—Hides intended for this tannery can be hung in the shade to drain thoroughly, and, indeed, partially dried (for weight saving in transport), then rolled up separately, hair inside, tied round with string to prevent opening up, and railed.

Hides to be dried out should be treated as follows:—Fold once lengthways, hair in, and hang over a rope or bamboo in the shade (if a rope used, to be kept quite taut). Bulging will thus be avoided at the fold, for it is of importance that dried hides should be as flat as possible throughout for the sake of appearance and to economise space in baling.

When quite dry, stack in cool, shady place, and take precautions to prevent attack by insects.

Railway Transport Charges.—Hides and skins consigned to this tannery are carried at 4th class rate (in lieu of 3rd), and wet salted, that is, good, not dried out, at a further reduction of 20 per cent.

A Pisé de Terre House.

In our last issue we reproduced two photographs of a pisé de terre house erected recently at Wensleydale farm, Macheke. The inscription omitted any reference to Mr. Kilburn's partner, Mr. Derry, who is equally responsible for the erection of the house.

Correspondence.

THE SWORD BEAN (*Canavalia gladiata*).

The following correspondence with reference to the sword bean between Sir Francis Newton and the Department of Agriculture will prove of interest, as the bean in question is grown largely in the Mazoe and Shamva districts, but its value as a vegetable is not generally known:—

To Sir Francis Newton.

"A sample of beans grown on your farm has been forwarded to me for identification. They turn out to be the sword bean (*Canavalia gladiata*). This differs from an allied species also grown extensively in this country, viz., the Jack bean (*Canavalia ensiformis*), in being a rambling vine and in having red seed instead of white seed.

"The sword bean may be fed to cattle, but is not highly esteemed for this purpose, as tests in the United States of America show that, although palatable to stock, it is not readily digestible. The following extract from a circular issued by the Bureau of Plant Industry on the subject may be of interest:—'The sword bean, unlike the Jack bean, is constantly used as a vegetable, and the pods are used in the half-grown stage, when they suggest mushrooms. It seems well worthy of attention as a vegetable throughout the Southern States.'

"I may add that I have personally tried them as a French bean and found them quite good.

"J. A. T. WALTERS,
"Agriculturist and Botanist."

From Sir Francis Newton, 28th July, 1921.

"Many thanks for yours of 21st *re* sword bean. I knew the name, but am very glad to get your information. We ate some—the beans are not like French beans, but like broad beans—on receipt of your letter and found them excellent. These beans do extraordinarily well here, and we are certainly going to grow them for kitchen garden and perhaps for a crop. Each plant bears a good many pods."

From Sir Francis Newton, 29th April, 1922.

" . . . I grew some more this year in the garden only, and would like to draw your attention to its extraordinary merit as a table vegetable at the green, very green, stage. It has a wonderful flavour; as you say, 'in the half grown stage they suggest mushrooms.' Of course, it has not done so well this year, but I mean to plant every bean I have next year. It does very well against a tree or on a fence or pergola, and bears heavily in a good place in a wet year."

Southern Rhodesia Veterinary Report.

March, 1922.

AFRICAN COAST FEVER.

No cases occurred during the month.

ANTHRAX.

Two cases occurred in the Mtoko district in cattle. All in-contact animals were vaccinated.

QUARTER-EVIL.

The following mortality in cattle was reported:—Hartley 2, Marandellas 1, Umtali 7, Insiza 2, Inyati 2, Bulawayo 3, Plumtree 6, Matobo 18, Gwelo 2, Enkeldoorn 5, Gutu 15, Belingwe 2, Gwanda 13, Victoria 44. A severe outbreak occurred in the Mtoko native reserve. The actual mortality was not recorded.

CONTAGIOUS ABORTION IN CATTLE.

Centres of infection were found in the Lomagundi, Bulawayo, Gwelo and Victoria districts.

MYIASIS (SCREW WORM) OF CATTLE.

There was a considerable decrease in this affection; seven cases only reported from two districts, viz., Gwanda and Bubi.

SWEATING SICKNESS OF CALVES.

Following cases reported:—Lomagundi 6, Bubi 5, Bulawayo 7, Plumtree 2, Belingwe 2, and several from the Victoria district.

FOOT ROT IN CALVES.

A serious outbreak of foot rot occurred amongst calves on a farm in the Victoria district. Practically all calves were affected, and the mortality was 25 per cent. The Director of Veterinary Research reports as follows on specimens examined by him:—"Examination of infected feet submitted showed a septic arthritis and coronitis and with sloughing of the hoof. From the lesions the bacillus necrophorus, an unidentified bacillus (a facultative anaerobe) and streptococcus were recovered and cultivated. Primary cultures proved deadly to rabbits in 12 hours. Subcutaneous inoculation of a rabbit with a piece of necrotic tissue gave rise to an abscess at the seat of inoculation, yielding pus containing the same three organisms. The inoculation of material infective to rabbits into a calf failed to produce any appreciable effect."

JOHNE'S DISEASE.

A Shorthorn bull destroyed in the Bubi district showed lesions of this disease.

HORSE-SICKNESS.

The following mortality was reported:—Lomagundi 3, Hartley 3, Bubi 1, Gwanda 3, Chilimanzi 1, Victoria 1.

SWINE FEVER.

A heavy mortality occurred amongst young pigs on the farm Dunstal, near Bulawayo, which was demonstrated to be due to swine fever.

IMPORTATIONS.

From Union of South Africa:—Bulls 12, heifers 40, horses 13, donkeys 63, sheep 2,366, goats 430.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 566, breeding cattle via Liebig's Drift 50, horse 1, pigs 276. To Congo:—Mules 4, donkeys 28, pigs 70, cows 18. To Northern Rhodesia:—Horses 5, mules 4, donkeys 14, sheep 20. To Portuguese East Africa:—Horses 2, mules 3, donkeys 26, cattle (mixed) for breeding 450, for slaughter 77, pigs 31, sheep and goats 30.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

Agricultural Outlook.

The season just past has proved one of the worst experienced in this country, and its effects are being felt severely. The rainfall over the greater part of the Territory was far below the average, and in many places the lowest on record. A most unfortunate feature was the failure of the rains during the growing season, with the consequence that in many cases crops have failed entirely, whilst in others greatly reduced harvests will be reaped. The statistics of the rainfall published elsewhere show the position exactly, and will repay perusal.

So far as maize is concerned, reports go to show that the total yield will be greater than was at one time expected, and while it will, of course, be much less than normal, there is not likely to be any shortage for local consumption. Early harvesting and shelling will be the vogue this year, and those farmers who have started to thresh should be careful to see that the grain is thoroughly dry before bagging, otherwise it will be liable to mould after it is stacked or stored. Much of the grain this year may be light and chaffy, owing to the early cessation of the rains, and therefore it may be difficult to get the usual quantity into the bag.

The tobacco crop has withstood the drought remarkably well, and although occasional failures and reduced yields are reported, yet as a whole a fair crop will be reaped. The leaf is in a number of instances of fine quality, and should realise good prices. Wildfire and angular spot are not so much in evidence this year, due undoubtedly to the treatment of the seed before sowing.

Farmers with irrigated land are likely to score this winter, as there will probably be a keen demand for potatoes, wheat and forage. There is plenty of scope in the country for a large addition to the number of small and inexpensive irrigation schemes. Owing to the light rainfall, the area of vlei lands capable of producing winter cereal crops will be smaller than in past seasons, but in spite of this many such crops are at the present time looking very promising. The restricted area is, however, to be the more regretted, since the country was making rapid strides towards producing its own wheat requirements.

The most serious aspect of the drought is the shortage of water. In many parts of the Territory streams which are usually running in October have given out, and the prospects are serious. Many farmers in Matabeleland are sinking wells and boreholes to provide water for stock, whilst in other cases it has been or will be necessary to shift cattle to better watered areas. Scarcity of grazing in some parts has also necessitated the transfer of stock to fresh pasturage, and generally it may be said that in many districts the ensuing winter months will be a period of severe trial. Those farmers who succeeded in growing crops for ensilage and who have stored ample supplies of hay and dry fodder will have reason for gratification.

The outbreak of African Coast Fever, to which we refer in an editorial notice, is disquieting, and demonstrates the necessity for the exercise of the greatest vigilance at all times. Cattle are reported generally to be thriving, and the rate of increase satisfactory. Statistics of the cattle in the country at the end of December last will appear in our next issue, but preliminary figures show that there are in Southern Rhodesia to-day over one-and-three-quarter million cattle, of which upwards of 900,000 are owned by Europeans.

Native crops in most parts of the Territory have failed, and relief measures have been undertaken by the Government. The bounteous harvests of the past few seasons have apparently not been conserved, with the consequence that a bad season finds the native to a great extent unprepared with any reserves of food.

Farming Calendar.

June.

BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

CITRUS FRUITS.

Cultivation of the grove is to be continued and pruning taken in hand towards the end of the month. Washington Navel oranges and some earlier varieties will be ready this month for gathering, packing and despatch.

CROPS.

The harvesting of the smaller crops will now be over, except possibly ground-nuts, mangels and dhal. Ground-nuts should be lifted before the first frosts. Mangels may safely be allowed to remain in the ground until required for use. Dhal will not be ripe until the end of the month, when the plants should be cut about a foot above the ground, allowed to dry for a few days, then shaken to free the seeds from the pods. Ploughing should be continued through the month, and, if the maize is cut and stooked, the fields can be ploughed between the lines of stooks.

DAIRYING.

With the advent of the winter months, dairy produce is not so liable to perish as in the hotter months. Cream producers can with advantage produce cream for the factories containing a slightly lower fat percentage, as cream is not so likely to go sour on account of lower atmospheric temperatures. With regard to next season's milk or cream supply, dairy farmers must ensure that the dairy cows are kept in good condition throughout the winter months, so that they can produce milk immediately after calving, and not require the first two months' fresh grass to bring them into condition, thereby losing what should be the best weeks of their production. A cow gives her utmost in milk from four to six weeks after calving, but she must be in good condition to do this.

DECIDUOUS FRUITS.

Pruning of deciduous trees should be done this month or in July.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and *Bagrada* bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perennials, shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

FORESTRY.

Burn out the grass in any fire traps round or near the plantation that were left unploughed. Any timber that is to be felled should be taken in hand this month.

GENERAL.

Grazing is giving out, and the next few months will be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire guards to prevent grass fires should be looked to.

POULTRY.

The nights during this and next month may be cold, and those whose fowls are housed in iron houses would do well to surround them and cover the roof with grass, otherwise the sudden fall in temperature is conducive to lowering the egg yield. Brick, pisé de terre and other thick-walled houses with thatched roofs are more suitable for cold nights. Continue to keep the breeding birds up to scratch. See that the hens do not become too fat, and that they and the male bird are kept free from insects; see especially to the feeding of the latter. He must be kept in good condition; feed him separately at mid-day, and give him a piece of raw meat the size of a walnut three or four times a week.

Do not force the breeding birds for eggs; this only results in unfertile eggs, poor hatches and weak chicks, and ruins the constitution of the birds. Even layers, i.e., for eating eggs only, should not be given anything of a forcing nature, such as spices and condiments.

Some of the young stock should now be over two months old, and coming along well. Give them as much range, exercise and food as possible. They must, too, have comfortable, airy houses, kept clean and free from insects, to develop into good birds.

Hatch all the turkey eggs possible from now on to six weeks before the rainy season commences.

STOCK.

Cattle.—There is every indication of a difficult winter season for horned stock, and the provision of water and food is in many parts a matter for anxiety. Where it is necessary to move cattle to fresh pasturage, this should not be unduly delayed. Dipping is best postponed during very cold snaps until a warm day occurs. Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground-nuts, ground-nut cake or bean meal. Young calves are better in the pens on very cold mornings

until the sun has gained some power, when they may run on short sweet veld for a few hours. The above remarks with regard to dipping and water supply apply equally to dairy as to ranching herds.

Sheep.—Sheep are best kept on the high veld for a while longer. If grass seeds are troublesome, a grazing area should be mown. If the rams were put into the flock in May, they should now be removed. Ewes with lambs will benefit by a few handfuls of mealies, and perhaps ensilage. They should be provided with shelter from cold winds.

VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. After twelve months in this Territory, sheep do not contract the disease. Inoculation can be carried out now. Scab is a poverty winter disease.

WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

July.

BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry out repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

CITRUS FRUITS.

Orange trees should be pruned this month, if this work is not completed. Groves must be well cultivated, especially after irrigation has taken place, and the soil round the trees hoed or dug over. Washington Navels will be gathered and some later varieties will be ready for picking. The irrigation of orange trees should be taken in hand when the trees are ready to commence the next growth.

CROPS.

See June.

DAIRYING.

See June.

DECIDUOUS FRUITS.

Pruning may be done this month.

ENTOMOLOGICAL.

Onions.—Thrip is liable to affect this crop, and when present calls for careful attention. Tobacco wash or paraffin emulsion should be used.

Deciduous Fruits.—Scale infested trees may receive a winter wash during this month. Lime sulphur salt wash or scalecide is recommended for this purpose.

Guava.—Citrus growers should always bear in mind that this fruit harbours citrus codling when there is no citrus fruit available. All guava trees, therefore, in the vicinity of citrus orchards should be stripped during this or next month, and the fruit buried deeply or burnt.

Fig.—Fig weevil may still be in evidence. The fruit is also sometimes attacked by citrus codling and other moths. The destruction of infested fruit is the most practical remedy for the pests.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

FORESTRY.

Cuttings of all ornamental shrubs, roses, etc., should be taken now before the spring growth starts. Plants grown in tins during the previous season should be re-potted as soon as the cold weather is over.

GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

POULTRY.

Watch the chicks carefully; it is the little details in chicken rearing that count. Never allow the air in the brooders to become foul. If the chicks in the brooders crowd one on top of the other, they are either too cold or lack sufficient fresh air. If they are cheeping and shivering, they should have more warmth. If they are gasping and their wings droop, they are too hot, and require more fresh air and ventilation. If they sleep spread out over the floor of the brooder, they are all right.

Avoid over-crowding at night; it is the cause of more deaths, weak chicks and poor stock than almost anything else.

When sending hatching eggs away, see that they are carefully packed and in such a manner as to reduce vibration to a minimum. It must be remembered that the germ of an egg is very delicate. Also always contract to have unfertiles returned after ten days, that is after the first testing, for many buying hatching eggs imagine that if an egg does not hatch it is necessarily unfertile, and wish such replaced. Those who buy hatching eggs should rest them for 24 to 36 hours before putting them into the incubator or under a hen. If this is not done, a poor hatch is the result.

Ducks should always sleep on dry bedding, which should be changed every alternate day. Wet, dirty bedding means cramp, rheumatism and no eggs. If you are going in for ducks, keep good ones; they lay better, and in every way are more profitable than cross-bred ones.

The hatching season is drawing to a close; don't hatch any chicks after the end of next month, but between now and then hatch as many as possible.

STOCK.

Cattle.—On ranches the advice given for June applies still. The bulls may again be put into the herd at the end of the month. If grazing has been reserved for the winter months, it will probably be wise to turn the cattle into it now. Watch for any unthrifty cattle, and get them into the home paddock and feed them before they become really poor. Dairy cattle will require heavy feeding now, and if plenty of roughage is available, cows in milk will do better if kept in for a while on cold mornings and turned out only after the warmth of the sun is felt.

Sheep.—Vleis should now be fairly dry and may be utilised: otherwise the advice given for June applies.

VEGETABLE GARDEN.

Sow turnips, beans, peas, onions, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none are looked for or desired this month. Most stations record an average of .01 to .3 inch over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

Southern Rhodesia Weather Bureau.

MARCH AND APRIL, 1922.

Pressure.—During the month of March the mean barometric pressure was normal in Matabeleland and below normal (0.06 in.) in Mashonaland. The fluctuations in the barometric pressure during the month were minor, the maximum range amounting to 0.15 in. only at Bulawayo and 0.09 in. at Salisbury. A high pressure area was present from the 8th to the 12th, the maximum high on the 10th being 0.07 in. above normal at Bulawayo and 0.03 in. below normal at Salisbury. Low pressure areas were present on the 22nd and 27th, the minimum low on the 22nd being 0.08 in. below normal at Bulawayo and 0.12 in. below normal at Salisbury.

During the month of April the mean barometric pressure was above normal (0.03 in.) in Matabeleland and normal in Mashonaland.

The fluctuations in the barometric pressure during the month were large, the maximum range amounting to 0.35 in. at Bulawayo and 0.27 in. at Salisbury.

Marked high pressure areas were present from the 3rd to 7th and 16th to 21st, the maximum high on the 5th being 0.17 in. above normal at Bulawayo and 0.12 in. above normal at Salisbury.

Low pressure areas were present on the 13th, 14th, 29th and 30th, the minimum low on the 30th being 0.18 in. below normal at Bulawayo and 0.15 in. below normal at Salisbury.

Temperature.—During March the mean temperature was above normal, and varied from 1.7° above normal at Umtali to 4.2° above normal at Gwelo.

The mean daily temperatures varied from 2.3° above normal at Umtali to 7.3° above normal at Salisbury. The mean night temperatures varied from 0.8° above normal at Bulawayo to 2.6° above normal at Gwelo.

During April the mean temperature varied from 1.3° below normal at Umtali to 1.5° above normal at Salisbury.

The mean daily temperatures varied from 1.6° below normal at Umtali to 4.7° above normal at Salisbury, whilst the mean night temperatures varied from 0.5° below normal at Umtali to 1.7° below normal at Salisbury.

Rainfall.—At the end of February the mean seasonal rainfall was far below normal over the whole country.

The position was not improved during March and April, as in no district was the mean rainfall during these months in excess of the normal.

During March rain in the form of scattered showers was general throughout the month.

During April no rain was recorded in Matabeleland; during the middle of the month good rains of 2 ins. or over were recorded along the eastern border, and at the end of the month light scattered showers in Mashonaland generally.

The following table shows the general position in the various rainfall areas during these two months:—

Area.	Mean rainfall, March, 1922.	Mean rainfall, April, 1922.
	Inches.	Inches.
Zone A (Western Matabeleland)	1.09	Nil
Zone B (Eastern Matabeleland)	1.29	Nil
Zone C (Western Mashonaland)	1.14	0.05
Zone D (North-Eastern Mashonaland)	0.93	0.20
Zone E (South-Eastern Mashonaland)	0.76	0.39
Zone F (Eastern Border)	1.09	1.76

March Rainfall.—In Zone A the mean fall varied from 2.17 ins. in Bulalima district to 0.54 in. in Bulawayo district.

In Zone B the mean fall varied from 2.58 ins. in Belingwe district to 0.37 in. in Gwanda district.

In Zone C the mean fall varied from 1.62 ins. in Salisbury district to 0.75 in. in Chilimanzi district.

In Zone D the mean fall varied from 1.23 ins. in Mazoe district to 0.09 in. in Darwin district.

In Zone E the mean fall varied from 1.07 ins. in Umtali district to 0.37 in. in Gutu district.

Late Rains.—During April the rains were negligible, except in the extreme eastern districts.

At the beginning of May general rains were reported in southern Matabeleland, and during the middle of the month scattered showers in various districts in Mashonaland.

The following is a summary of the rainfall recorded during May up to the time of writing (18th May) in the districts from which daily reports are received:—

	Rainfall, 1st to 18th May. Inches.
Zone A—	
Bulawayo	0.82
Bubi	0.16
Zone B—	
Bulalima	2.19
Belingwe	0.77
Gwanda	1.48
Umzingwane	1.18
Zone C—	
Charter	0.27
Hartley	0.25
Lomagundi	0.09
Salisbury	0.06
Zone D—	
Darwin	0.24
Inyanga	0.11
Mazoe	0.04
Mrewa	0.76
Zone E—	
Gutu	0.26
Makoni	0.26
Victoria	0.16
Zone F—	
Melsetter	0.60

Seasonal Rainfall.—Owing to the abnormal season a general summary of the rainfall distribution throughout the season will be of some interest.

The season opened extremely well with good early rains, which were general and well sustained up to the end of December. On that date the rainfall over the whole country was in excess of the normal, with the exception of the extreme eastern districts, where there was a slight deficiency.

January was characterised by the longest drought period ever experienced in Mashonaland since records were kept, the total fall during this month being less than an inch at practically all stations in the country.

During February there were comparatively good general rains during the period 1st-10th, but after that date to the end of March only light scattered showers were experienced in various parts of the country.

During April the rainfall recorded in the country generally was negligible, except in the eastern districts.

General late rains were experienced in southern Matabeleland during the first week in May and scattered showers in the remainder of the Territory.

The following summary affords a means of comparison of this

season's rainfall compared to the previous worst season experienced in the various districts:—

District.	Mean rainfall, 1921-22, to 18th May. Inches.	Mean rainfall, previous worst season. Inches.	Year.	Mean rainfall, 1921-22, 1st Jan. to 18th May. Inches.	Mean rainfall after 1st Jan., previous worst season. Inches.	Year.
Zone A.						
Bubi	15.93	12.74	1913-14	2.53	7.73	1913-14
Bulalima	13.47	10.37	1913-14	5.68	8.02	1913-14
Bulawayo	15.57	12.58	1912-13	3.18	6.60	1913-14
Gwelo	13.96	13.28	1913-14	2.18	5.00	1916-17
Wankie	21.03	14.17	1915-16	10.42	6.20	1915-16
Zone B.						
Belingwe	17.62	12.68	1916-17	4.31	8.40	1916-17
Bulalima	14.20	10.37	1913-14	5.96	8.02	1913-14
Gwanda	10.98	9.90	1916-17	3.26	5.66	1913-14
Insiza	12.78	12.75	1915-16	2.42	5.70	1916-17
Matobo	11.46	11.33	1915-16	2.82	7.41	1915-16
Umzingwane	12.01	11.96	1915-16	2.87	6.89	1916-17
Zone C.						
Charter	17.65	14.96	1915-16	4.69	6.10	1916-17
Chilimanzi	19.02	16.01	1915-16	2.35	5.59	1916-17
Gwelo	15.84	15.54	1911-12	2.63	5.25	1916-17
Hartley	18.52	19.40	1916-17	5.50	7.69	1916-17
Lomagundi	21.24	21.71	1911-12	8.18	17.09	1913-14
Salisbury	18.71	20.58	1902-03	7.43	10.49	1916-17
Zone D.						
Darwin	22.07	16.05	1909-10	6.86	13.39	1909-10
Inyanga	19.67	19.89	1911-12	4.20	12.27	1915-16
Makoni	15.38	22.63	1913-14	3.63	12.69	1915-16
Mazoe	21.17	21.35	1916-17	9.53	15.65	1916-17
Mrewa	17.07	22.22	1905-06	6.51	14.95	1916-17
Salisbury	21.68	22.53	1915-16	7.46	13.10	1916-17
Zone E.						
Charter	21.71	16.95	1915-16	6.78	8.32	1915-16
Chilimanzi	19.27	16.01	1913-14	3.65	8.01	1915-16
Gutu	16.44	17.88	1911-12	2.64	11.11	1915-16
Gwelo	18.55	15.58	1915-16	2.58	9.33	1915-16
Inyanga	17.61	25.88	1916-17	4.68	11.66	1916-17
Makoni	14.91	19.80	1911-12	3.63	12.19	1915-16
Marandellas	17.39	19.35	1915-16	3.56	16.49	1915-16
Melsetter	27.08	28.27	1911-12	10.66	13.95	1915-16
Selukwe	17.51	20.69	1915-16	3.10	12.58	1916-17
Umtali	15.78	18.72	1911-12	7.28	8.71	1911-12
Victoria	14.10	15.36	1915-16	3.63	6.22	1915-16
Zone F.						
Melsetter	31.50	36.52	1915-16	11.23	22.43	1915-16

This summary shows clearly that the general rains since 1st January this season have been the worst on record in all districts, with the exception of Wankie. But as regards the seasonal total, there are worse years on record in all districts, with the exception of Lomagundi, Salisbury, Inyanga, Makoni, Mazoe, Mrewa, Gutu, Marandellas, Melsetter, Selukwe, Umtali and Victoria districts. A drought period in December or January is comparatively common, but on no previous occasion has the rainfall after the drought period been so markedly less than the early rains as was the case this season.

RAINFALL.

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	March.	April.		
ZONE A. :				
Bubi—				
Imbesu Kraal	·60	—	17·63	23·65
Inyati	1·03	—	13·91	23·75
Bulalima—				
Kalaka	·58	—	11·32	21·66
Riverbank	3·75	—	13·97	22·78
Bulawayo—				
Fairview Farm	·56	—	10·57	22·25
Keendale	·20	—	13·99	20·15
Lower Rangemore	·54	—	13·02	23·36
Observatory	·32	—	14·46	23·29
Paddy's Valley	1·09	—	17·52	23·14
Gwelo—				
Dawn	·69	—	13·22	26·19
Somerset Estate	1·26	—	14·70	24·31
Wankie—				
Waterford	·95	·02	22·00	23·36
ZONE B. :				
Belingwe—				
Bickwell	4·61	—	16·85	20·72
Bubje Ranch	·54	—	7·47	20·40
Bulalima—				
Garth	·89	—	10·48	25·13
Retreat	3·29	—	12·94	20·52
Tjankwa (Syringa)	·50	—	9·35	23·45
Tjompanie	2·13	—	15·29	23·33
Gwanda—				
Gwanda Gaol	·68	—	10·13	20·26
Mtshabezi Mission	·30	—	8·97	22·17
Tuli	·13	—	9·40	14·39
Insiza—				
Albany	1·68	—	13·14	20·56
Filabusi	·70	—	11·47	21·00
Fort Rixon	1·01	—	12·42	21·28
Infiningwe ... ..	...	...	...	25·22
Inyezi	1·25	—	14·22	21·00

RAINFALL—(Continued).

STATION	1922.		Total to end of period.	Normal rainfall to end of period.	
	March.	April.			
Zone B.—(Continued)					
Matobo—					
Holly's Hope	·99	—	9·95	21·93
Rhodes Matopo Park	·80	—	10·97	22·70
Umzingwane—					
Essexvale	·90	—	10·83	23·65
ZONE C. :					
Charter—					
Bushy Park	·85	—	15·24	25·91
Enkeldoorn	·60	·06	22·03	28·81
Marshbrook	·81	·34	19·61	28·87
Range	·32	·09	19·86	31·00
Umniati	·30	—	13·16	23·30
Vrede	1·86	—	14·38	28·70
Chilimanzi—					
Wylde Grove	·75	·10	19·02	25·49
Gwelo—					
Cross Roads	1·53	·14	16·11	24·82
Globe and Phoenix Mine	1·11	·10	18·17	28·41
Rhodesdale Ranch	·41	—	15·01	25·96
Woodenhove	1·55	—	15·13	28·56
Gwelo (Gaol)	2·22	—	14·78	25·78
Hartley—					
Ardgowan	2·24	—	26·49	30·50
Beatrice...	1·37	—	20·85	28·30
Carnock	·56	·08	16·90	31·00
Philipphaugh	1·80	—	11·93	31·10
Cromdale	3·28	—	17·81	...
Elvington	1·18	—	17·17	31·05
Gatooma	1·56	·22	20·70	30·97
Gowerlands	1·62	—	17·27	29·55
Hallingbury	1·74	·05	18·33	27·77
Hartley Gaol	1·68	—	19·25	32·06
Jenkinson	1·44	—	20·88	29·27
Nyagordi	·38	—	18·74	29·60
Ranwick	2·40	—	20·71	29·70
Spitzkop	1·38	—	17·45	30·06
Lomagundi—					
Argyle	·53	—	21·30	32·94
Darwendale	1·10	—	18·48	30·77
Gambuli	2·51	·21	22·09	37·10
Lone Cow Estate	1·33	·03	22·40	33·29
Maningwa	34·83
Mrindagomo	1·14	·04	18·04	...
Mukwe River Ranch	1·10	—	20·81	30·84
Palm Tree Farm	1·06	—	21·54	32·05
Sinoia	·44	·15	24·84	31·00
Sipolilo	1·70	—	23·94	31·14
Talfourd	·54	—	18·01	32·28

RAINFALL (Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	March.	April.		
ZONE C.—(Continued)				
Salisbury—				
Avondale	1·44	—	21·13	31·43
Botanical Experiment Station...	1·73	—	16·90	32·60
Bromley	·90	—	18·81	33·15
Cleveland Dam	2·20	·17	20·04	30·13
Gwebi	1·12	—	17·20	33·74
Hillside	1·78	·23	18·16	29·84
Lilfordia	1·98	—	18·13	29·89
Salisbury Gaol	2·08	—	16·88	31·49
Sebastopol	·50	·03	18·31	32·10
Stapleford	2·22	—	19·87	33·30
Tisbury	1·91	·28	19·71	31·52
Vainona	·51	·08	18·28	33·50
Sebungwe—				
Sikombela	·72	—	16·57	28·39
ZONE D. :				
Darwin—				
Mount Darwin	·09	·01	21·83	30·76
Inyanga—				
Inyanga	1·01	...	...	36·63
Rhodes Estate	1·68	·78	19·56	35·83
Makoni—				
Eagle's Nest	·51	·17	15·12	32·11
Wensleydale	1·74	...	...	31·40
Mazoe—				
Benridge	1·09	—	18·08	34·46
Bindura	1·05	·13	18·98	34·71
Ceres	1·52	·05	21·64	38·42
Citrus Estate	·58	·19	18·48	32·17
Craigengower	1·72	·12	23·27	35·50
Kilmer	1·73	—	20·97	35·26
Kingston	1·12	·17	25·02	37·00
Mazoe	2·23	·12	23·43	32·31
Mazoe Dam (centre)	1·93	·02	20·49	36·45
Omeath	·84	·06	23·87	31·84
Ruia	2·23	—	20·26	39·23
Ruoko Ranch	·25	·06	26·29	33·02
Rustington	1·28	—	20·11	32·20
Shamva	1·13	—	17·54	34·64
Stanley Kop	·22	—	19·40	30·86
Sunnyside	·55	·27	20·77	34·00
Teign	1·89	·08	24·67	35·60
Virginia	·73	—	17·20	31·00
Zombi	1·74	·16	28·41	36·20
Mrewa—				
Glen Somerset	·21	·10	14·74	35·34
Mrewa	1·16	·41	19·32	34·93
Selous Nek	·89	·17	17·66	34·42

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	March.	April.		
Zone D.—(Continued)				
Mtoko—				
Makaha	·38	·04	13·97	37·20
Mtoko	·45	·08	18·65	28·53
Salisbury—				
Glenara	1·15	—	22·99	31·00
Goromonzi	3·09	·09	21·79	38·19
Meadows	·34	·08	20·27	39·29
ZONE E. :				
Belingwe—				
Belingwe	·80	—	12·70	28·25
Charter—				
Buhera	·36	·15	21·44	29·88
Chilimanzi—				
Chilimanzi	1·31	—	18·08	26·62
Driefontein	·50	·11	16·87	26·61
Felixburg	·47	—	19·95	30·41
Grootfontein	·62	·10	18·01	27·09
Induna Farm	1·41	—	23·44	28·58
Gutu—				
Guta	·43	·07	21·35	29·75
M'vimvi Ranch	·30	·14	12·72	28·15
Tel-el-Kebir	·37	·22	15·38	29·24
Gwelo—				
Oaklands	1·25	—	16·67	30·21
Partridge Farm	1·16	·08	21·27	29·50
Sheep Run Farm	·87	—	17·70	29·40
Insiza—				
Thornville	2·70	...	...	26·43
Inyanga—				
St. Trias' Hill	·81	·39	17·61	39·35
Makoni—				
Chimbi Source (Chitora)	·23	·32	12·54	35·00
Craigendoran	·59	·21	15·33	30·61
Forest Hill	·08	·09	11·71	37·00
Gorubi Springs	·29	·05	11·72	37·41
Mona	·72	—	18·37	34·71
Monte Cassino	·57	·12	19·30	34·40
Rusape	·02	—	13·60	31·85
Springs	1·99	—	...	36·82
Marandellas—				
Bonongwe	·45	—	20·89	30·43
Delta	2·24	·03	17·16	35·73
Land Settlement	1·68	·13	16·88	32·50
Lendy Estates	·49	·02	16·92	33·90
Marandellas	·37	—	16·78	36·06
Nelson	·15	·26	15·70	30·38
Melsetter—				
Brackenbury	·45	3·61	27·43	50·42
Melsetter	1·33	·28	24·56	44·51
Tom's Hope	1·16	2·48	27·46	46·00

RAINFALL (*Continued*).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.		
	March.	April.				
ZONE E.—(Continued)						
Ndanga—						
Bikita	56	1·11	26·06	58·99
Doornfontein	78	38	19·98	34·30
Selukwe—						
Hillingdon	1·04	10	16·96	30·90
Rio	95	03	18·06	28·34
Umtali—						
Gilmerton	77	1·20	12·54	30·81
Jerain	2·09	32	16·01	32·23
Mutambara Mission	1·22	78	15·74	28·82
Odzani Power Station	31	1·41	24·06	35·08
Premier Estate	14	62	14·92	29·30
Stapleford	2·09	2·60	47·32	63·10
Umtali (Gaol)	88	1·03	11·12	31·13
Victoria—						
Cavan	1·99	—	15·92	27·63
Clipsham	13	10	10·44	28·63
Gokomere	32	44	16·02	25·55
Histonhurst	16	95	12·17	...
Makahori Farm	45	—	14·67	...
Makorsi River Ranch	24	—	12·92	32·89
Morgenster Mission	12	...	39·93
Riverdene North	17	—	14·05	30·66
Silver Oaks	14	09	12·26	28·31
Stanmore	12	05	14·73	27·00
Summerton	37	—	15·68	26·10
Tichidza	79	29	16·53	34·80
Victoria	15	04	13·91	26·00
ZONE F.:						
Melsetter—						
Chikore	02	1·48	22·52	46·85
Chipinga	20	2·26	26·50	47·05
Helvetia	2 58	...	...	58·00
Mount Selinda	77	1·89	30·33	66 15
Vermont	1·39	4·28	37·00	63 40
Umtali—						
Hoboken	1·19	1·64	23·37	57·20

— means nil.

... means no return.

Dates of Meetings of Farmers' Associations, Southern Rhodesia

(SUBJECT TO ALTERATION)

Name of Association	Place of Meeting	Secretary	1922		
			June	July	August
Banket Junction ..	Banket Hotel	Hon. J. S. Parker	..	1	5
Beattie District ..	Farmers' Hall, Beattie	W. Kriake	3	27	31
Bindura ..	Bindura ..	G. Askew	29	8	12
Bromley ..	Bromley ..	C. J. Shirley	10	6	8
Darwin ..	Arundia Farm and Mt. Darwin Store	..	..	..	..
Eastern Border (South Masetter)	alternately	J. W. Goucher	11	9	13
Eastern Districts ..	Farm Havenwood	J. Fawcett-Joile (<i>pro tem</i>)	No	fixed	dates
Enterprize ..	Georgetown School	J. E. V. J. Frey	10	8	12
Felixburg—Gutu ..	Arcturus Hotel	Mrs. V. J. Frey	7	8	12
Figtree Branch, R.L. and F.A.	Willard Farm	F. W. Bradshaw	10	28	23
Gabad ..	Figtree Hotel	A. S. Will	28	26	23
Gatooma ..	Hunyani Drift	A. Kelsey-Harvey	15	20	17
Gatooma ..	Speck's Hotel	E. Seale	17	15	19
Greytown ..	Chippinga	W. Wood	..	6	8
Greytown ..	Various houses, Shangani	..	10	6	12
Greytown ..	Royal Hotel, Gwanda	A. C. Edmonstone	..	..	..
Headlands ..	Headlands	J. de L. Nimmo	22	22	26
Hunter's Road Farmers and Stockowners	Hunter's Road Siding	R. W. Twilley	..	..	..
Inyanga ..	Shangani ..	M. E. Weale	17	15	19
Inyanga ..	Rhodes Inyanga Estate	E. J. Hacking	10	8	12
Lalapani ..	Inyanga ..	R. H. Everett	20	18	15
Lalapani ..	Inyanga ..	R. E. Clarke	17	17	21
Lonequand ..	Sinola ..	J. G. Clarkson	2	..	4
Macheke ..	Macheke	W. L. McLean	No	fixed	dates
Makwiro ..	Makwiro	..	16	21	18
Makoni North ..	Makoni South Farm	J. G. Monckton	28	26	30
Makoni ..	Rusape	Lionel Dobell	10	8	12
Marandellas Northern	Marandellas Farmers' Hall	H. Jackson	3	1	5
Marandellas Southern	Marandellas	S. A. Gibson	5	5	8
Marandellas ..	Commercial Hotel, Salisbury	S. A. Gibson	1	..	..
Masopo Branch, R.L. and F.A.	Various farm houses	G. G. Coghill	..	fixed	dates
Masop ..	Glendale	Mrs. D. D. Peacey	14	12	11
Masop Central ..	Masop	P. D. Peacey	9	14	11
Masetter (North) ..	Masetter	J. Harvie	3	..	5
Masetter ..	Cronley	R. Wodehouse	No	fixed	dates
Northern and Stockowners	Royal Hotel, Gwelo	A. Muller	20	18	15
Northern District	Farmer's Field	W. Wrench	No	fixed	dates
Northern and District	Norton Store	G. Graham	No	fixed	dates
Nyanandlovu ..	Nyanandlovu	E. J. Ross	17	15	19
Que Que ..	Que Que	H. S. Hopkins	..	27	..
Rhodesian Landowners and Farmers	Library Buildings, Bulawayo	C. C. Douglas	17	15	19
Sabotus ..	Various farms	W. T. Simpson	17	15	19
Sabatwe ..	Sabatwe	H. S. Hopkins	17	15	19
Unyake ..	Various ranches	Mrs. M. A. Bracewell	17	15	19
Unyake ..	Royal Hotel, Untali	J. S. Holland	17	15	19
Unyuma District and Stockowners	Unyuma	M. W. Graham	1	29	26
Victoria ..	Victoria	W. F. N. Thornton	2	7	4
Western ..	Plumtree Hotel	W. B. Goucher	10	8	13

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

CATTLE TRANSPORT AREAS.

It is hereby notified that the boundaries of areas within which the movement of cattle in use for draught purposes is permissible have been fixed as described in the subjoined schedule, as provided for by section 9 of Government Notice No. 21 of 1917, as amended by Government Notice No. 602 of 1921.

Veterinary Department,
20th January, 1922.

J. M. SINCLAIR,
Controller of Stock.

No. 1.—PLUMTREE AREA.

An area bounded by and including the land lying south and east of the following boundary, from that point on the Zambesi Panda-matenka Road, where it crosses by the Manzamnyama River; thence up this river to its intersection by Butler's Road shortly west of Marapu's Kraal; thence direct north for a distance of 600 yards; thence in a direct line to the western beacon of the Sedgwick Syndicate Extension Block; thence by and including the following farms—Nata Reserve, Kirby Block, Pandis, Sherwood, Manda, Mananda, Wilfred's Hope, Marshlands, Three Streams, Shashani Outspan, Shashani farm, and Warneford to the Shashani River; thence down this river to the north-east beacon of Semokwe Reserve; thence along the east and southern boundaries of this reserve to the Semokwe River; thence down this river to the southern boundary of this territory.

No. 2.—FIGTREE AREA.

An area bounded by and including the following farms—Reserve, Vunda, Bickley, Beckenham, Penge, Norwood, Ascot Estate West, Welcome, Paul's Rest, Honeybird Kop, Vreigevecht North, La Concorde South, De Hoop, Forwards; thence to a point where the Ove River crosses the south-eastern boundary of Forwards; thence down the Ove River to where it intersects Ove North and along the northern boundary of Ove North and Gumella; thence by and including the following farms—Undza, Lushongwe, Malala, Kezi, Rosenfel's Junction and Valley; thence along the southern boundary of Mount Edgecombe to its south-west beacon; thence in a northerly direction along the eastern boundary of the Plumtree area to the point first named.

No. 3.—BULAWAYO AND BEMBESI AREA.

An area bounded by and including the following farms—Collaton, Irene, Broadwell, Klipsoring, Joe's Luck, Letterstedt, Pendennis, Millevale, Ireland, Ascot Estate, Naseby North and South, Stanhope South, Mkuse, Chesa, Luvu, Samunya, Thornvalley Block, Redleaf, Stavens, Claverhouse, Seale, Springfield, Spring Grange, Galeta's Kraal, Reserve, Umgusa Block, and Bletchingly Block; thence along the north-eastern boundaries of Winter, Springs, and Eland to the south-western beacon of Westland Row; thence along the western boundaries of Westland Row, Bembezaan, Westgate and Molecomb to the south-east beacon of Pioneer Block East; thence along the southern and western boundaries of this block to its north-west beacon; thence in a straight line to the south-west beacon of No. 31 of the Shangani Native Reserve; thence along the western, northern and eastern boundaries of this reserve to its beacon No. 6 on the Shangani River; thence up this river to the northern beacon of Kenilworth Block; thence along the north-western boundary of this block to the northern beacon of Crescens Syndicate Block; thence by and including this block, Accutts, Dromoland, Fairbairns, Chilton, Half Ration Ranch, Wessels, Allandale B, Greenlands, that portion of Lochard Block north of the Bulawayo-Gwelo railway line, Clonmore, Lochard Reserve, Fochabers, Kodhwayo and Zimbili, Victory, Kirton, Wilsendale, Duncal, 100 acre lots, Gumtree, Claremont, Reserve, Emangeni, Adams, Boomerang, Nil Desperandum, Sauerdale and Alnwick.

No. 4.—INSIZA-BELINGWE AREA.

An area bounded by and including Allandale A and C, Oscardale, St. Ninian's, Judsonia, Bulawayo Syndicate Block, Murray's farm, Frei's farm, Mambo, Auckland, Sunny Ranch, Kenilworth Block, Craig Flower, North Shangani farm and North Beldan's Block, Baltimore, Lynes farm, South Shangani Block, Woodend, Ruby Block, East Shangani Block, excluding that portion of this block occupied by the Daisyfield Siding and Orphanage; thence by and including East Shangani Block, Liscard, Belmont, Forfar, De Beers Block and Torwood Lee; thence down the western boundaries of Lundi Reserve and Zeederberg's Block, excluding Brooklands farm; thence along the southern and eastern boundary of this block to the Shabi River; thence down this

river to its junction with the Lundi River; thence down this river to where the Victoria Column Road crosses it; thence down this road in a southerly direction to the Nuanetsi River; thence up this river to where it crosses the Old Fort Mpatene Road, down this road to Gerber's Store; thence along the Geelong-Gwanda Road to the south-eastern beacon of Grasspan; thence in a northerly direction along the eastern boundaries of the farms Grasspan, Krantzklouf, Itaga, Good Luck; thence in a northerly direction along the eastern and northern boundaries of the Balla Balla and Filabusi areas, the southern boundary of the Bembesi Station transport area with access to Bembesi Station.

No. 5.—NYAMANDHLOVU.

An area bounded by and including the following farms—Moana, Wainoni, Loskey, Espenanza and Merryland, Cawston Block, Umguzaan Block (excluding sub-division A of same), Hilda's Kraal, Tableland, Rochester, Acutt and Crewe, Sevui, Alicedale, Imvani, Springs, North Stanhope, Bromley, Eden, Riverbank, Mananza, Dhlulu, Kalaka, Zimzomba, Sedgwick Syndicate Extension Block, that portion of the Nata Reserve north of the Plumtree area to the point where the Nata River crosses the Zambesi Road; thence in a straight line across the Gwaai Reserve to the Gwaai River and the south-west beacon of Ughwindhla; thence by and including the following farms—Ihlobo, Isilomo, Inseze, Forest Hill, Seafeld, Norfolk, Buchanan, Langslaagte and Matabeleland Concession.

No. 6.—GWAAI STATION.

An area bounded on the west by the Malindi area and on the south by the Plumtree area, on the east by the Bembesi Station area to the Pioneer Block West; thence by and including this block, Bognor, Carthage, Dangan, Euston and Fienne's farm to the Gwaai River; thence up this river to the junction of the Bembesi River; thence in a straight line in a south-west direction to the point where the Nata Reserve crosses the Zambesi Road.

No. 7.—MALINDI.

An area bounded on the south by the Nyamandhlovu Station and Gwaai Station area, on the west by the Bembesi Station area to the Karna River; thence down this river to the Karna Block, including this block; thence down the Shangani River and the Gwaai River to the Inyantue River; thence up this river to the eastern boundary of the Wankie Coal Area; thence in a southerly direction along the boundary of this area to its south-east beacon; thence in a straight line to a point on the Zambesi Road twenty miles south of the Wankie Deka Road.

No. 8.—WANKIE.

That portion of the native district of Wankie lying to the north of the Malindi transport area.

No. 9.—MATOPO TERMINUS.

An area bounded on the west and north by the Plumtree, Figtree and Bulawayo areas and from the farm Florencedale by and including

Florencedale and the Matopo Native Reserve; thence along the northern boundaries of Leilavale and Wenlock Block to the south-west beacon of Reserve; thence by and including Reserve, Inkonyana, Isifuma, Shukwe, Walmer, Lismore, Lyndhurst, Hulughwesi and Msulungwe; thence direct from the south-east beacon of the latter to the south-east beacon of Alicedale, to the east beacon of Semokwe Reserve.

No. 10.—ESSEXVALE.

An area bounded by and including the following farms—Glen Grey, Bushy Park, Napier's, Springvale, Umzingwane Reserve, Worringham, Hilton, Ballarat, Essexvale, Inyankuni, Hamilton, Mayfair, York, Spitzkop, and Yazani.

No. 11.—BALLA BALLA AND FILABUSI.

An area bounded by and including the following farms—Glass Block, Rhodesia, Ltd., Block No. 2, Fairgrove, Charter, Irisvale, Lynch's, Clark's, The Range, Glen Latagan, Enyema, Swaithes, Limerick, Pioneers' Rest, Hayhill, Insiza Block, Rietfontein, Bradford, Fairview, Kildare, Lancaster, Blagdon, Gala, Kalanga, Bolo, Umtata, Komgha, Baneya, Izolo, Tsomo, Zuka, Uyanezi, Inyezi, Leeuwhoek, Ingwanya, Eastcliff, Hillside, Arcadia, England, Good Hope, Good Luck, Rocky Spruit, The Range, Imbondu, Mpane Vale, Waterfall and George's farm.

No. 12.—GWANDA.

From the junction of the Shashi and Semokwe Rivers north along the Semokwe River to the Semokwe Reserve, and along the southern and eastern boundaries of that reserve to the west central beacon of Tabesinyoni, south to its south-west beacon and along the southern boundaries of Tabesinyoni and Alicedale to the south-east beacon of the latter; thence in a direct line east to the southern beacon of Msulungwe and the southern boundaries of Togher, Plaisance, Fresnaye and Chita; thence by and including the farm Makwe Nsambaan; thence along the west and northern boundaries of Wenlock Ranch and the northern boundaries of Leilavale and Zwemele Block, by and including Hollin's Block, Granite Kopje, The Grange, Longfield, Lynch's, Kirby, Henderson, Strathmore, Penawerne, Rhodesia, Ltd., No. 1; thence along the western and southern boundaries of Glass Block to the Umzingwane River, south along the Umzingwane River to the south-east beacon of Railway Block No. 1; thence along the southern boundary of Railway Block No. 1 to the north-east beacon of Exchange; thence by and including Exchange, Rathgar, Thornwood Block, Bromley, Macaulay, Jahoonda, Makalaka Kop, Leeuwhoek, Sweetwaters, Pourri Perri, west along the southern boundary of Pourri Perri and along the western and southern boundaries of Oakley Block, Mlanye, Doddieburn Ranch to the Umzingwane River; thence south along the Umzingwane River to the Shobi Block, and along the northern, western and southern boundaries of Shobi Block to the Umzingwane River, south along the Umzingwane River to the eastern boundary of Elwes Block, and south along this boundary in a direct line to the Limpopo River; thence west along the Limpopo and Shabi Rivers to the point first named.

No. 13.—WEST NICHOLSON.

An area bounded by and including Copthall Block No. 2, Maluta, Cleveland Block, Kiaelana, Railway Block No. 2, Oakley Block, Doddieburn Ranch; thence from the point where the Umzingwane River crosses the southern boundary of Shobi Block; thence along the northern, western and southern boundaries of Shobi Block to the north-eastern boundary of Elwes Block; thence along the eastern boundary of this block to the Limpopo River and down this river to Liebig's Drift; thence in a northerly direction along the eastern side of the Mazunga-Messina Road to the southern boundary of Jopompi Block; thence by and including Jopompi Block and Wanesi Block, up the Nuanetsi River to the southern boundaries of the Insiza, Belingwe and Filabusi areas, the eastern boundaries of the Gwanda area to the point started from.

No. 14.—VICTORIA.

From the confluence of the Sabi and Devuli Rivers; thence up the latter river to where it crosses the eastern boundary of Caledon Estate; thence along the east and south boundaries of that estate to the south boundary of Gutu Reserve; thence along the south boundary of Gutu Reserve to the Chomfuli Hill, and thence south-west from this hill to the north-east beacon of Chikwanda Reserve; thence along the north boundary of this reserve to the Zimutu Reserve; thence along the north boundary of Zimutu Reserve to its north-west beacon, from the latter beacon due west to the Makaholi River, down this river to the north-east beacon of Makaholi farm, along the north boundaries of Makaholi, Climax, Redmond, Liberty, to the south-east beacon of Chilimanzi Reserve; thence along the south boundary of Chilimanzi Reserve to the Ngesi River, down this river to the eastern beacon of 50 per cent. farm, and thence including this farm and Tokwe Block to the Tokwe River, down this river to where the Victoria and Belingwe Road crosses; thence along this road, but including it, to where it crosses the Lundi River; thence down this river to where the Pioneer Column Road crosses; thence down the same road, but including it, to where it crosses the Nuanetsi River, down this river to the most easterly beacon of Wanesi Block; thence along the south boundary of Wanesi Block, the east and south boundaries of Jopompi Block, to where the Mazunga-Messina Road crosses; thence down this road, but excluding it, to the south boundary of this Territory; thence in an easterly and north-easterly direction along the boundary of this Territory to the Sabi River; thence up this river to the junction of the Sabi and Devuli Rivers.

No. 15.—CHILIMANZI.

From the point where the Ngesi River crosses the south-western boundary of the farm Ensimeon, down that river to the south-west beacon of the Chilimanzi Reserve, along the south boundary of this reserve, the northern boundaries of Liberty, Redmond, Climax to the Makaholi River, and up this river to the north-east beacon of Thornhill farm; thence in a direct line to the south-west beacon of Chatsworth farm, along the south boundaries of the farms Ingogo, Rocklands, Merrilies, Morpeth and Dysart, and from the south-west beacon of this farm in a direct line to the Chomfuli Hill; thence along the southern

boundary of the Gutu Reserve and Caledon Estate to the Devuli River, and down that river to its confluence with the Nyadzidza, and up that river to where it crosses the southern boundary of Lancashire; thence along the southern boundary of Lancashire to its south-west beacon, and along the eastern boundary of Welwart, the eastern and southern boundaries of Lionsdale, the southern boundary of Silverdale, the northern and western boundaries of Widgeon and the northern boundaries of Felixburg, Crown Lands and Good Hope to the Shashi River; thence down this river to the northern boundary of Chilimanzi Reserve; thence along this boundary to the Ngesi River.

No. 16.—UMVUMA.

An area enclosed by a line drawn from the confluence of the Sabi and Devuli Rivers, up the former to the south-eastern beacon of Sabi Oog; thence northwards along the eastern boundaries of Sabi Oog, Sunnyside and Pinhoe; thence by and including Pinhoe, Bucknall, Glynn, Erdington Estate and Roan; thence along the western boundaries of Revelant, Ngesi, Shinghaini, Brooklyn, Wheelerdale, Verwachting, the northern boundary of Umgesi Reserve to the boundary of Rhodesdale Estate; thence southerly along the eastern boundary of this estate to the Central Estates; thence by and including Central Estates, Pela, Chieftain; thence from the southernmost beacon of this farm along the southern boundaries of Grassridge and Glencoe to the Sitola River and down this river to the Sitola farm; thence in an easterly direction along the northern boundary of the farms Kentucky, Castile and Missouri to the Ngesi River and up this river to Ensimeon; thence by and including Ensimeon, Richmonds, Vosges, Kombisa, Makanya, Gussen, Chakastad, Delos, Sessebi, Driefontein B, Shasha, Fountains, Alanverry, Silverdale, Lionsdale and Welwart; thence along the southern boundary of Lancashire to the Inyazitza River; thence down this river and the Devuli River to the point started from.

No. 17.—LALAPANZI.

An area bounded by a line from the north-eastern beacon of Roslin, following the western boundary of the Rhodesdale Estate in a north-easterly and north-westerly direction to the Umniati River; thence up this river and Ngesi River to the south-west beacon of the Mondoro Reserve; thence following the eastern boundary of Rhodesdale Estate, the north-western and south-western boundaries of Central Estates to the south-eastern beacon of the farm South View; thence including the farms Faerdan, Crossmalooft; thence along the southern boundary of this farm to the north-eastern beacon of the farm Grassridge; thence along the south-eastern boundary of this farm and Glencoe to the Sitola River; thence down this river to the farm Sitola; thence by and including Sitola, Kentucky, Castile, Missouri, Arcadia, Inyakarri, Melford and Dunsinane to the Tokwe River; thence up this river in a northerly direction to the southern beacon of the farm Anstruther; thence down the eastern boundary of the farm Royston; thence along the southern boundaries of this farm, Chiltern and Hilton; thence in a northerly direction, including the farms Hilton, Grenfels, Killarney, Partridge,

Wojelle, Hill View, Woodendhove, Ifafa, Dunrobin, Buti and Wyanko; thence along the northern boundary of Que Que Reserve and eastern boundary of Roslin to the point started from.

No. 18.—GWELO.

An area bounded by a line drawn from a point on the Shangani River where it enters the Shangani Reserve, northwards along the boundary of that reserve to the Gwelo River, and up that river to the southern beacon of Stevenson A Block; thence up the eastern boundary of Stevenson A Block and in a direct line across to the southern beacon of Summer View; thence directly south to join the boundary of the Main Belt Block; thence up and including the following farms—Warwick, Lyons, Paris, Argyle, Roscobie, Basildon, Vermont, Upsale, Torwood, Ripple Creek, Penderry, Yeoville, Zoe, Limeridge, Foxton, Harston, Braehead, Strathfillan, Barton, Wodehouse, Ardpatrik, Que Que Reserve, Mzizu, Elizabeth, Wold, Ingeli, Umgeni, Woollahra, Linslade, Hashu, Guburie, Hainhault, Highlands, Safago, Slades, Engesi Source, Beacon Kop, Wall Close, Comyn Ranch Extension B, Cragola, Haricrun, West Gwelo Block, Ghoko Block, including the farms Adamantia, Brown's farm, St. Patrick, Dewhurst, Fairfield, Drummond, Lawndale, Woodlands, Kenilworth A, B, C and D, Dawson's, to the railway siding Daisyfield; thence northwards along the eastern boundary of the East Shangani Estate and the northern boundary of Dawson's; thence along the northern boundary of this farm to the farm Johnstone, along the western boundaries of this farm, Vungwana South, Vungwana North and Walton; thence by and including Blink Klip, Zenda, Gilman, Barehill, Ceylon, Clare, South Beldans Block, Terva Block and Milne Block; thence down the Shangani River, excluding the farm Craigflower, to the point started from.

No. 19.—SELUKWE.

An area bounded on the north by the Gwelo and Lalapanzi areas, on the east and south by the Victoria transport area, on the south and west by the Insiza and Belingwe transport area.

No. 20.—HUNTER'S ROAD.

An area bounding and including the following farms—Adair, Barclay, Boschkloof, Long Valley, Northfield, Melrose, Nettlethorn, Orpheus, Quorn, Redfields, Irene, Krom Rivier, The Calliegh, Shawlands, Loads, Sunbury and Garryowen.

No. 21.—QUE QUE.

An area bounded by a line drawn from the south-west beacon of the Sebakwe Estate; thence along the eastern and northern boundaries of Sherwood Block to the south-east beacon of Glover's farm; thence along the eastern boundary of this farm to the Umniati River, down the Umniati and Sinyati Rivers to the junction with the Zambesi, up that river to its junction with the Sengwe, and up that river to its junction with the Lutopi River; thence in a straight line due south to the Shangani Native Reserve; thence along the northern and eastern

boundaries of this reserve to the Gwelo River, and up the latter river and the north boundaries of the Gwelo and Hunter's Road transport areas to the south-west beacon of the farm Roslin; thence along the southern and eastern boundaries of this farm; thence north-easterly along the western boundary of Rhodesdale Estate to the point started from.

No. 22.—SALISBURY.

An area bounded by and including the following—Kungwi, Chikwakwa, Msana and Chindamora Native Reserves, the farms Pote, Balkiza, Thetford, Spelonken, Christian Bank, Eskbank, Komani, Good Hope, Reserve, Haydon, Kinvarra, St. Marnock's, Arden, Forest Reserve, Ngamina, Penrose, Ballineety, Bitton, Reserve, Nauwe Plaats, Oude Kraal, Klein Kopjes, Leeuws Rust, Oakwoods, Sandhurst, Umvokwe, Oog, Brinsham, Pucklehills, Oldlands, Greenside, Sodbury and Charfield; thence along the eastern boundaries of Eclipse Block and Gwebi Junction farm to the Hunyani River, up the latter to the north-west beacon of Chilanza farm; thence along the northern boundaries of this farm, Suum Cinque and Brechin, the western boundaries of Brechin and Duiker, the eastern boundary of the Mondoro Native Reserve, the northern boundaries of Wheelerdale, Brooklyn, Shinghaini, Ngesi and Revelant, the western and northern boundaries of Roan to the old Charter-Salisbury Road; thence along this road to the south-west beacon of the farm Guildford; thence along the southern boundaries of this farm, Guzha and the Seki Native Reserve to its south-east beacon; thence along the eastern boundaries of this reserve, Great Bromley Estate, Weardale and Waterford, the western and northern boundaries of Rastenburg and Loquat Grove to the Inyagui River, and down the latter to the Kunzwi Native Reserve.

No. 23.—GWEBI TANK HALT.

An area including the following farms—Darwendale, Gwebi Junction, Eclipse Block, Downend and Fish Ponds.

No. 24.—MARANDELLAS NORTH.

An area including the following farms—Musi, Peddie, Southampton, Roraima, Essexvale, Rockery, Progress, Shepperton, Longlands, Shortlands, Rastenburg, Loquat Grove, Helm, Cotter, Rapid, Revolt, Rokodzi, Pirate, Bovey Tracey, March, Rocklands, Forest Range, Cornwall, Somerset, Dorset, Buckingham, Ulva, Sunny Fountains, Mangwendi Mission, Tiller, Rapture, Seaton, Warwick, Cambridge, Nandu, Weir, Argosy, Rapture, Dormervale, Oxford, Norfolk, Surrey, Sussex, Suffolk, Kent, Middlesex.

Note.—Access will be granted for ox transport from the above described area on to Uplands, subject to the condition that no such wagons be outspanned on the south side of the railway.

No. 25.—MARANDELLAS SOUTH.

An area bounded by a line drawn from the most northerly beacon of Gatzi, along the western boundaries of that farm and Nolans, and the

northern boundaries of Retreat and Springvale, and the southern boundaries of Rokodzi and Longlands, and from the southernmost beacon of that farm along its western boundary to the railway; thence westwards along the railway to where it enters Peddie; thence along the northern boundary of that farm and Musi, the western boundaries of Musi and Hedon, the northern and western boundaries of the Shiota Reserve to the Umfuli River; thence southwards along the old Charter-Salisbury Road to the northern boundary of the farm Roan; thence along the northern boundaries of Erdington Estate, Glynn, Bucknall and Pinhoe to the farm Balmoral; thence along the western boundaries of this farm, Corfe, Vergenoeg, and Good Hope to the Sabi River, and thence down that river to its junction with the Macheke River, up the latter to the Rusawi River; thence up the Rusawi River to the farm Chiswana; thence by and including Chiswana, Tweedjan, Nyakurwi, Elandslaagte, Somerslust, Soshwi Reserve, Wenimbi Estate, Nolans and Gatzi to the point first named.

Note.—Access will be permitted for draught oxen from the transport area immediately to the north of that herein described on to Uplands, provided such wagons are outspanned only to the north of the railway.

No. 26.—LOMAGUNDI.

The native district of Lomagundi, excluding Reynardia, Rothwell Extension, Hunyani Estate, Darwendale, Fish Ponds, Greenside, Oldlands, Pucklehills, Brinsham.

No. 27.—BINDURA.

An area bounded by a line drawn from the south-east beacon of the farm Gosforth, along the Glendale No. 46 and No. 45, Dunmaglas, Duntarvie, Makori and the Chiwesha Native Reserve to the native district of Darwin; thence by and including this district to the Mazoe River, up this river and the Inyagui River to the Chikwakwa Native Reserve; thence along the northern boundaries of this reserve, the Msana and the Chindamora Reserve to the point started from.

No. 28.—HARTLEY, GATOOMA AND BATTLEFIELDS.

An area bounded by a line drawn from the junction of the Umfuli and Umniati Rivers, up the latter and the Sebakwe River to the south-west beacon of Sebakwe Estate; thence in a north-westerly direction along the western boundary of Rhodesdale Estate to where the railway line crosses the southern boundary of Battlefields farm; thence along the railway line to the Umsweswe River, up this river to the eastern boundary of Umsweswe River Block; thence following the northern and eastern boundaries of Rhodesdale Estate to the Ngesi River; thence up that river to the south-eastern boundary of the Mondoro Reserve; thence along this boundary to the Doronanga River; thence down this river to the Umfuli and down the latter to the western boundary of the Mondoro Reserve; thence in a northerly direction along the western boundary of this reserve, the southern boundary of Farnley, the southern and western boundaries of Marsden, the western boundaries of Braeside, Jenkinstown, Ardmore, Makwiro Source, and Philiphaugh;

thence by and including the farms Hunyani Estate No. 2, Railway farm No. 29 and Hunyani Estate, Rothwell Extension and Reynardia in the native district of Lomagundi; thence down the Umsengaise and Umfuli Rivers to the point started from.

No. 29.—NORTON SIDING.

An area bounded by and including the following farms—Cressydale, Tankatarra, Lydiate, Elston, Philiphaugh, Makwiro Source, Ardmore, Jenkinstown, Braeside, Marsden, Farnley, that portion of the Mondoro Native Reserve north of the Umfuli River, Greendale, Cecil, Elladale, Glanrhyd, Reserve, Austria, Marshlands, Reserve and John o' Groat's.

No. 30.—PASSAFORD STATION.

An area consisting of the farms—Umsasa, Mbebi, Springvale, Passaford, Great B, Estes Park, Spa, Fairview, Weltevreden and Mackay, Reserve, Sandown, Jackal's Loop, Mooi Leegte, Tavydale, Nauwe Plaats, Oude Kraal, Goede Hoep, Oakwoods, Klein Kopjes, Leeuws Rust.

No. 31.—MAZOE.

An area bounded by and including the following—Barwick Estate, Howick Estate, Burley Bottom, Belford Estate No. 2, Belford Estate and Belford Estate No. 3; thence from the north-west beacon of Msasa along the northern boundary of that farm, the western, southern and eastern boundaries of Great B, to the southernmost beacon of Arnold's; thence along the northern and eastern boundaries of Spelonken, the northern boundaries of Thetford and Pote to the Pote River; thence down this river to the farm Gosforth; thence along the eastern boundaries of this farm, Leopard's Vlei, Geluk, Glendale No. 46 and No. 45, Dunmaglas, Duntarvie and Makori, and the Chiweshe Native Reserve to the northern boundary of the Mazoe native district; thence along the northern and western boundaries of this district to the Barwick Estate.

No. 32.—MACHEKE STATION.

An area bounded by a line drawn from the north-western beacon of Showers, along the western boundaries of Showers, Gongwe, Magar, northern and western boundaries of Highlands, north-western and south-western boundaries of Allen, western boundary of Holton Estate, western and southern boundaries of Belmont Outspan, north-western boundary of White Gombola, western boundaries of Bonn, Calne, Wilton, northern and southern boundaries of Delta and southern boundaries of The Cave and Mere; thence up the Macheke River to the south-western beacon of Monte Cassino, to its most northern beacon; thence in a direct line to the south-western beacon of Changwe Ranch No. 1; thence along the northern boundary of Fairfield Estate to the Nyagadzi River, down this river to the border of Mrewa native district; thence by and including the native districts of Mrewa and Mtoko, excluding the farms Rap-ture and Argosy.

No. 33.—SOUTH UMTALI.

An area bounded by and including Umtali Townlands, Devonshire, Weirmouth, Hillandale, The Grove, Dora Estate and Nelson; thence

following the Odzi River to its junction with the Wengesi; thence bounded by and including Umvumbu, Muromo, Clydesdale, Engwa; thence in a northerly direction following the Portuguese border to the north-eastern beacon of Lowlands, adjoining the Umtali Townlands.

No. 34.—MID MELSETTER.

An area bounded by and including the farms—Weltevreden, Welgegund, Sawerombi, Cambridge, Admiral, Ashbourne, Brooklyn, Zebra, Brackenbury, Rockwood, Highlands, Joppa, Merrywaters, Voorspoed, Uitkyk, Bloemhof, Nyhodi, Greenmount, Belmont, Vooruitzicht, Rocklands, Dunblane, Clifton and Constantia.

No. 35.—SOUTH MELSETTER.

The surveyed farms in Melsetter district south of the Tanganda, Sterkstroom and Lusitu Rivers, with access to Umtali *via* the new Sabi Valley Road.

Review.

THE "JOURNAL OF THE WESTERN PROVINCE AGRICULTURAL SOCIETY."

We welcome the first issue of the *Journal of the Western Province Agricultural Society*, edited by Mr. D. T. Cuthbert, B.Sc. The Western Province Agricultural Society is to be complimented on its new venture, which is capable of being of very great benefit to its members, on whose behalf it is particularly prepared. The primary object of this *Journal* is to circulate information regarding the activities of the society, but it will also publish information of general interest to the members. The *Journal* is the official organ of the Jersey Cattle Breeders' Society of South Africa, and will probably be adopted by other similar organisations. The effort is to be warmly welcomed as a genuine attempt at a farmers' organisation to encourage its members and to increase its powers for good. The first issue contains an interesting history of early agricultural societies at the Cape of Good Hope, an account of the latest Rosebank Show, an article on the education of the farmer, and an outline of the discussion of the question of autumn and spring shows, which is engaging much attention in the south. The society's annual wine show and annual stud stock sales are activities which might be copied by other agricultural societies with advantage. We wish the new venture every success.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 218. Useful Measurements for Maize, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 252. Cultural Notes on Buckwheat, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 396. Export of Maize.

- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.
- No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 400. Soil Washing, by A. C. Jennings, Assoc.Mem.Inst.C.E.
- No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
- No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia.
- No. 408. The Velvet Bean, by J. A. T. Walters, B.A.
- No. 416. Grasses of Agricultural Importance in Southern Rhodesia, by H. G. Mundy, F.L.S., G. N. Blackshaw, O.B.E., B.Sc., F.I.C., and E. V. Flack.
- No. 417. The Ground Nut or Monkey Nut, by C. Mainwaring.
Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
- No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
- No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
- No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
- No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
- No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
- No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
- No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
- No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
- No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
- No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
- No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.
- No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
- No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
- No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.

TOBACCO.

- No. 132. Sumatra Tobacco, Hints to Rhodesian Growers, by C. J. Sketchley.
- No. 333. Tobacco Culture—Field Operations, by H. W. Taylor, B.Agr.
- No. 339. Tobacco Culture; Harvesting and Curing, by H. W. Taylor, B.Agr.
- No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
- No. 347. Tobacco Pests of Rhodesia, by R. W. Jack, F.E.S.

- No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
 No. 398. Wildfire and Angular Spot.
 No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision),
 by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.
 No. 410. Common Mistakes in Growing and Handling Virginia Tobacco,
 by H. W. Taylor, B.Agr.
 Handbook of Tobacco Culture for Planters in Southern Rhodesia,
 price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by
 Eric A. Nobbs, Ph.D., B.Sc.
 No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
 No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season
 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.
 No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D.,
 B.Sc., and B. Haslewood, F.S.S.
 No. 231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs,
 Ph.D., B.Sc., and B. Haslewood, F.S.S.
 No. 247. Statistical Returns of Crops grown by Europeans in Southern
 Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D.,
 B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S.,
 Statistician.
 No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A.
 Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
 No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
 No. 296. Statistics of Live Stock and Animal Produce for the Year 1917,
 by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
 No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and
 F. Eyles, F.L.S.
 No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles,
 F.L.S.
 No. 361. Statistics of Live Stock and Animal Produce for the Year 1919,
 by F. Eyles, F.L.S.
 No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia,
 1919-1920, by H. C. K. Fynn.
 No. 393. Statistics of Live Stock and Animal Produce for 1920, by
 H. C. K. Fynn.
 No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia
 for the season 1920-21, by H. C. K. Fynn.

LIVE STOCK.

- No. 123. Feeding and Care of Imported Bulls, by R. C. Simmons.
 No. 145. Prospects of Importation of Cattle from Australia, by E. A.
 Nobbs, Ph.D., B.Sc.
 No. 208. Water in the Diet of Live Stock, by L. E. W. Bevan, M.R.C.V.S.
 No. 211. Fattening of Pigs on Granite Farms in Mashonaland, by
 R. C. Simmons.
 No. 227. An Experiment in Beef Production, by R. C. Simmons.
 No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
 No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by
 A. G. Holborow, F.I.C., Assistant Government Agricultural
 Chemist.
 No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
 No. 255. Pound Fees.
 No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed
 Farms, by R. C. Simmons.

- No. 292. Branding and Drafting Pens, by R. C. Simmons.
- No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
- No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
- No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
- No. 336. Butchering and Flaying.
- No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
- No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.
- No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.
- Arsenite Cattle Dip—How to Mix.

DAIRYING.

- No. 243. Shedding for Milch Cows, by R. C. Simmons.
- No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.
- No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
- No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
- No. 356. Cream and its Production, by T. Hamilton.
- No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 395. Farm Butter Making, by T. Hamilton, M.A., N.D.D., N.D.A.
- No. 401. Milk Records and Milk Testing, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 418. Manufacture of Cheddar Cheese, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
- No. 121. Rabies, by L. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
- No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
- No. 202. Distomatosis or Liver Fluke in Cattle and Sheep, by Rowland Williams, M.R.C.V.S.
- No. 289. Contagious Abortion in Cattle, by Sir Arnold Theiler, K.C.M.G.
- No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.
- No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by L. E. W. Bevan, M.R.C.V.S.
- No. 324. Infectious Abortion of Cattle, by L. E. W. Bevan, M.R.C.V.S. Services of Government Veterinary Surgeons.
- No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.
- No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.
- Redwater Treatment and Gall Sickness.

IRRIGATION.

- No. 186. Concrete and Reinforced Concrete, by E. Hardcastle, M.I.E.E.
- No. 206. Hints on Irrigation: Small Earthen Storage Reservoirs, by W. M. Watt.

- No. 270. Odzani River Irrigation Scheme, by W. M. Watt.
 No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.
 No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
 No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.
 No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.
 No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
 No. 419. Irrigation Canals, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E. Engineering Advice.

FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.
 No. 217. Windbreaks and Hedges, by F. B. Willoughby.
 No. 267. Trees for Farm and Ornamental Purposes, by W. E. Dowsett.
 No. 366. The Management of Woods, by J. S. Henkel.
 No. 379. Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds.
 No. 386. Forestry in Rhodesia: Improvement Fellings on the Farm, by J. S. Henkel.

HORTICULTURE.

- No. 75. Fumigation of Fruit Trees with Hydrocyanic Acid Gas, by R. W. Jack, F.E.S.
 No. 354. The Home Orchard, by A. G. Turner.

ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
 No. 147. Root Gallworm, by R. W. Jack, F.E.S.
 No. 158. Two Ladybirds Injurious to Potato Plants, by R. W. Jack, F.E.S.
 No. 171. The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants, by R. W. Jack, F.E.S.
 No. 172. Diseases of the Potato Tuber and the Selection of Sound Seed, by R. W. Jack, F.E.S.
 No. 178. Illustrations of Natural Forest in relation to Tsetse Fly, by R. W. Jack, F.E.S.
 No. 187. The Dusty Surface Beetle, by Rupert W. Jack, F.E.S.
 No. 197. Chafer Beetles, by R. W. Jack, F.E.S.
 No. 204. Some Injurious Caterpillars, by R. W. Jack, F.E.S.
 No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
 No. 219. More Household Insects, by R. Lowe Thompson, B.A.
 No. 228. Rhodesian Citrus Pests, by R. W. Jack, F.E.S.
 No. 233. Does it Pay to Spray Potatoes in Southern Rhodesia? by Rupert W. Jack, F.E.S.
 No. 249. Home-made Fly Papers, by Rupert W. Jack, F.E.S., Government Entomologist.
 No. 261. Turnip Sawfly, by R. W. Jack, F.E.S.
 No. 276. The Maize Stalk Borer, by Rupert W. Jack, F.E.S.
 No. 280. The Maize Beetle, by R. W. Jack, F.E.S.
 No. 290. Notes on Remedies for Turnip Sawfly, by Rupert W. Jack, F.E.S.

- No. 291. Outworms, by Rupert W. Jack, F.E.S.
 No. 302. A Note on the Maize Stalk Borer, by Rupert W. Jack, F.E.S.
 No. 317. Maize Culture on Red Soil; Value of Poisoned Bait as an Aid to Good Stands, by Rupert W. Jack, F.E.S.
 No. 353. Further Experiments with Poisoned Bait on Maize Lands, by R. W. Jack, F.E.S.
 No. 369. The Bean Stem Weevil, by R. W. Jack, F.E.S.
 No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.
 No. 402. Ticks Infesting Domestic Animals in Southern Rhodesia, by R. W. Jack, F.E.S.

POULTRY.

- No. 371. Ducks, by A. Little.
 No. 377. The Fowl Tick, by A. Little.
 No. 390. Poultry Husbandry: The Incubation and Rearing of Chicks, by A. Little.
 No. 406. The Turkey, by A. Little.
 No. 415. Mating for Improvement and Increased Egg Production, by A. Little.
 No. 420. Poultry Husbandry: Housing and Feeding of Adult Fowls, by A. Little.

MISCELLANEOUS.

- No. 93. Formation of Agricultural Credit Associations in Rhodesia, by Loudon M. Douglas, F.R.S.E.
 No. 129. How to Make Use of the "Fencing Ordinance, 1904," by N. H. Chataway.
 No. 226. Classification of Clouds, by R. H. Scott, F.R.S.
 No. 254. Hints on Explosives, by W. M. Watt.
 No. 264. Nature Notes—Adaptation, by C. F. M. Swynnerton, F.L.S.
 No. 273. Enkeldoorn Produce Express Syndicate Rules.
 No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.
 No. 283. Maize Foods for the Home.
 No. 294. Directions for taking Samples for Analysis, by E. V. Flack, Acting Agricultural Chemist.
 No. 318. Notes on Mining Law for Farmers, by Advocate D. E. McCausland, M.A., LL.B.
 No. 358. Notes on the Regulations governing the Sale of Fertilisers and Farm Foods, by E. V. Flack.
 No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
 No. 391. Hints on Brickmaking, by G. T. Dyke.
 No. 414. Limestones in Southern Rhodesia, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
 Malarial Fever: How it is caused and how it may be prevented, by Sir Ronald Ross, F.R.C.S., D.Sc., LL.D., F.R.S., K.C.B., etc.
 Directory of Rhodesian Farmers and Ranchers.
 The Analyses of Agricultural Products, Soils, Water, etc.
 Lectures for Farmers.

Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 178 of 1922.]

[28th April, 1922.

HIS Honour the Administrator has been pleased, under section 5, sub-section (6) (e) of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 369 of 1913 and provide as follows :--

1. No person, firm or corporation shall manufacture, import, sell, barter or exchange any virus, serum or analogous product used for the diagnosis or treatment of diseases of animals without the permission in writing of the Controller of Stock or Chief Inspector.

2. No person shall use any virus, vaccine, serum, blood, bile or analogous product for the diagnosis or treatment of animals without the permission in writing of the Controller of Stock or Chief Inspector.

3. Any person desiring to import, manufacture, sell, barter or exchange or to use any of the above-mentioned substances or products shall apply to the Controller of Stock or Chief Inspector for his requisite permission, which may be refused or granted under such conditions as the Controller of Stock or Chief Inspector may impose.

4. Any person contravening any of the above regulations or failing to observe the conditions attached to any permit issued in terms of the last preceding sub-section shall be liable on conviction to a fine not exceeding £20, or, in default of payment of any fine inflicted, to imprisonment with or without hard labour for a period not exceeding three months.

No. 180 of 1922.]

[28th April, 1922.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 435 of 1921, and in terms of section 17 of Government Notice No. 21 of 1917 declare the following area of infection and guard area in lieu thereof :—

MATOBO NATIVE DISTRICT.

(a) *Area of Infection.*

The farms Mauwe, Mount Francis, Famookwe, Mount Edgcombe and that part of the Matopo Mountains lying west of the Malundi River.

(b) *Guard Area.*

An area including that portion of the Matopo Mountains lying west of the Ove River; that portion of the farm Ove North lying west of the Ove River; the farms Gumella, Undza, Lushongwe, Mavuli, Store, Matibi, Smith's, Roy's, Warneford, Shashani, Ravenswood and Driefontein.

No. 212 of 1922.]

[19th May, 1922.

IT is hereby notified that His Honour the Administrator has been pleased, under and by virtue of the powers conferred on him by the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 595 of 1920 and to make the following provisions in lieu thereof :

1. A charge of one penny per head will be made in respect of all cattle dipped at Government dipping tanks in solution fixed for dipping at intervals of seven days.

2. A charge of one penny and a half-penny per head will be made in respect of all cattle dipped at Government dipping tanks in solution fixed for dipping at intervals of fourteen days.

3. Provided, however, that no charge will be made in either case for unweaned calves.

No. 216.]

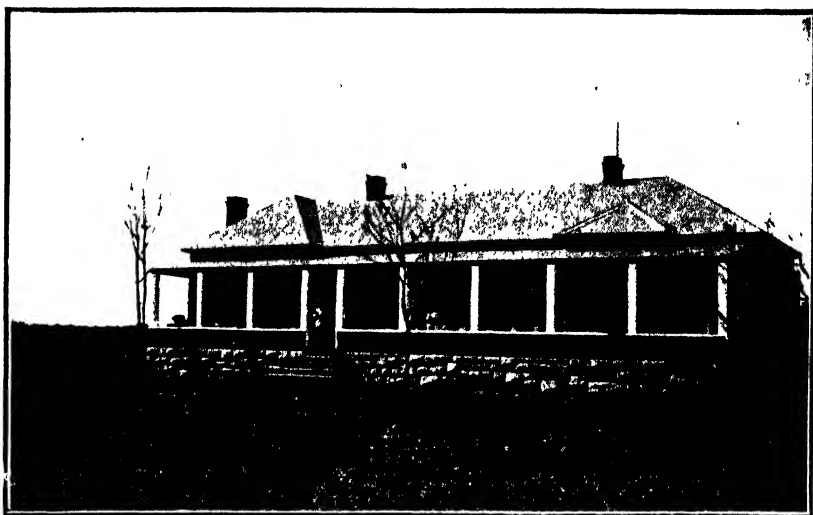
[19th May, 1922.

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.

IT is hereby notified that the following applications have been made for authority to use water:—

Name of applicant.	Farm.	Native district of	From what river.	Nature of application.	Purpose for which required.	Period for objection.
Macgillivray, Miss J. C.	Duntarvie ...	Mazoe ...	Little Sambi	To divert public water	To irrigate 50 acres	1 month
Harris, V. R. ...	Sub-division "A" of Craigendoran	Makoni ...	Unnamed stream	To divert public water	To irrigate 3 acres	1 month
Pearson, A. ...	Thordyke	Hartley ..	Serui ...	To store and abstract public and storm water	To irrigate 92 acres	1 month
Harvey, R. ...	Argyll ...	Umtali ...	Umtali ...	To divert public water	To irrigate 35 acres	1 month
Harrold, H. C. ...	Lot No. 3, Embeza Valley	Umtali ...	Embeza ...	To divert public water	To operate a ram	1 month

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within the period above specified from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of these applications, together with a full statement of the grounds for such objections.



Homestead on Mr. T. M. McMurray's farm, Tjankwa, Syringa.



Homestead on Mr. V. M. Ewing's ranch, Braemar, Bubi district.



THE RHODESIA
Agricultural Journal.

Issued by the Department of Agriculture.

PUBLISHED BI-MONTHLY.

Subscription : 5/- per annum.

VOL. XIX.]

AUGUST, 1922.

[No. 4.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

Statistics.—We publish in this issue of the *Journal* statistics of live stock and animal produce for the year 1921. It will be seen that the total number of cattle in Southern Rhodesia at 31st December, 1921, was 1,763,144, an increase of 16.2 per cent. over the total for 1920 of 1,517,293 head. Of the total, 908,646 are owned by Europeans and 854,498 by natives, representing percentage increases over the figures for 1920 of 17.5 and 14.7 respectively. The net average increase per cent. for the five years 1917-1921 is for all cattle 12.90 per cent. The figures quoted do not include live stock in urban areas, as distinguished from stock on farms, and it is of interest to refer to the Census taken on 30th April, 1921. The Census shows that on that date there were in the urban areas 14,830 head of cattle, 3,559 equines, and 53,774 poultry of all kinds.

The rapid increase which is taking place in our herds will be realised by comparing the figures for 1915—when statistics were first collected—with those now published. It will be seen that during this period our cattle have more than doubled in number.

The statistics contain data of the utmost importance to the farming community, and we commend them to the careful perusal of our readers.

East Coast Fever.—Up to the end of June the total mortality at Wiltshire Estate from East Coast fever was 725 head. The other centres of infection are:—Swartfontein and Chipesi farms, situated in the Charter district, and Mooifontein, which is adjacent to Umvuma. At Swartfontein the total number of deaths at the end of June was 61, at Chipesi one, and at Mooifontein three. These areas are under police supervision, and a strong veterinary staff has control of the measures taken to eradicate the disease.

In the Melsetter district the centres of infection are the farms Merino, Bamboo Creek and Randfontein. The total mortality, according to latest advices, is about 80 head. No fresh outbreaks have occurred recently, and the disease appears to be well in hand. Mr. Sinclair, Chief Veterinary Surgeon, has been in the Melsetter district for some time following events.

The Citrus Industry.—The final meeting of the temporary committee of the Fruit Growers' Exchange of South Africa, Ltd., was held in Johannesburg on 18th July. At that meeting a permanent board of directors was elected representative of the whole of the fruit-growing industry of South Africa and Rhodesia. As the Exchange is now in actual being, a meeting of Rhodesian fruit growers has been called to take place in Salisbury during Show week. The Rhodesian Co-operative Fruit Growers' Association has been duly registered, and it is now necessary to make a call for the purpose of obtaining funds to pay for the registration fees and other incidental expenses, as well as to take up a proportion of the shares in the Fruit Growers' Exchange of South Africa, Ltd. These matters will receive consideration at the meeting in Salisbury, at which an exposition will also be given of the work of the parent body and the policy of the association. It is to be hoped that all interested will make a point of being present, for the business in hand is of great importance.

Malaria and Blackwater Fever.—A very valuable lecture dealing with these diseases was delivered by Dr. J. G. Thomson, Director of Protozoology and Lecturer at the London School of Tropical Medicine, at Mazoe, on the 14th June, and reported in the *Rhodesia Herald* of 22nd June. Dr. Thomson's services have been lent to the Rhodesian Administration by the institution named, and he has been actively

engaged for the past four months in investigating the problem of the incidence of malaria and blackwater fever in the Territory. We regret that space does not permit of the reproduction of the report in this issue, and we must content ourselves with this passing reference. We have at various times published in this *Journal* information on the subject passed to us by the Medical Director, and we have at the present time available for free distribution the following literature:—

Malarial Fever: How it is caused and how it may be prevented,
by Sir Ronald Ross, F.R.C.S., D.Sc., LL.D., F.R.S., K.C.B.,
etc.

Health and Clothing.

Simple Rules for the Treatment of Ordinary Malaria.

Twelve Simple Rules for the Avoidance of Malaria and Blackwater
Fever.

Malaria and Blackwater Fever: Lecture by the Medical Director.

Dr. Thomson's lecture traverses much of the ground covered by these pamphlets, and in a great measure reaffirms the preventive and curative treatment prescribed. There is every reason for believing that malaria and blackwater fever can be avoided, and we commend those of our readers who live in malarial districts to make themselves acquainted with what has been written on the subject, and to follow strictly the advice tendered by these eminent authorities.

A Baboon Trap.—In our April issue we published an article by Mr. H. C. K. Fynn which drew attention to the existence of a baboon trap invented and patented by a farmer named Bowker, residing in the Cradock district, Cape Province. Since the article appeared a number of farmers in this Territory have expressed a desire for further information regarding the trap, and the Department has been in communication with the inventor on the subject. Mr. R. M. Bowker, whose address is Box 60, Graaf Reinet, states that the trap has been a great success, and quotes the names of a number of farmers in the Union who have tested it. In one instance he states 500 baboons have been trapped, in another 400, and in others 200. The trap, according to Mr. Bowker, will catch anything from a monkey to a tiger. "There is no getting out once in, provided the trap is properly made."

Mr. Bowker suggests that farmers wishing to make one of these traps should purchase from him a photo of the contrivance, with written instructions how to make the trap. The charge is 20s., and it is stated that with the photo and instructions in front of one a mistake cannot be made. If, however, it is desired to purchase a trap from Mr. Bowker, his charge is £4 10s. on rail, c.o.d.

Velvet Beans.—The following extract from a letter by Mr. C. V. Piper, Agrostologist in the Department of Agriculture of the United States of America, will be read with interest:—

"I have been very much interested in your article entitled, 'The Velvet Bean,' in the *Rhodesia Agricultural Journal* for February, 1922. I am writing you in regard to the identity of the species of velvet bean which you call the 'white stingless.' I have long been contemplating publishing an additional paper on the velvet bean, but various matters have delayed me. Your white stingless bean is the only herbaceous species of *Stizolobium* in Africa that does not have stinging hairs on the pods. The first material we ever saw of this species was received from Dr. Schweinfurth, of Berlin. This included both forms with ash-gray seeds and with ash-gray mottled with brown. When we grew these we found the two forms to be the same species, but differing only in the colour of the seed, as occurs in other species. The species is very close to *Stizolobium cinereum*, but differs from all others in that the minute pubescence on the pod is erect so as to give a peculiar feel. There are some other technical differences which I will not touch on here. Later we received, under the name of 'Dedman bean,' from the Director of Agriculture, Salisbury, Rhodesia, the form with the ash-coloured seeds, and still later from Messrs. C. Stark and Company, Mowbray, South Africa, the same thing under the name of 'kudu-laing bean.' Both of these forms are identical with the ash-coloured form of Schweinfurth's *Mucuna taborensis*. So far as I can ascertain, Schweinfurth never published his species, at least had not up to the time of my last correspondence with him. Some of these days I shall publish it under the name of *Stizolobium taborense*. What I think is undoubtedly this same species I have found mentioned in several African publications under the name of *Mucuna lindro*, which name, however, has never been published."

It will thus be noted that the Florida velvet bean (*Stizolobium deeringianum*) is distinct from the white stingless species.

Our Exports.—The Customs returns for the first quarter of 1922 show that 1,173 slaughter cattle, valued at £7,481, were exported from this Territory, as compared with 2,215, valued at £18,284, for the corresponding period of 1921. The value of "all other" cattle exported during the period mentioned is £7,175, against £4,798 in 1921. The Customs returns for April and May are not yet available, but as will be seen from the veterinary reports published in this issue of the *Journal*, a considerable increase in the exports of slaughter stock is recorded during these months, the figures being 1,499 head in April and 1,503 head in May. The corresponding figures in 1921 were 189 and 523 respectively. Our exports of butter for the first three months of 1922 show a considerable decline, the value totalling £8,186, against £26,209 in 1921. The universal drought experienced during the period under review is responsible for the drop. Our exports of maize meal approximate the figures for 1921, the quantities being 8,686,236 lbs. in 1922 and 8,854,374 lbs. in 1921. There is, however, a big difference in the values, the meal exported during 1922 being valued at £17,916, and that in 1921 at £40,639. The exports of whole maize in 1922

amount to 4,011,269 lbs., valued at £7,575, against 1,150,303 lbs., valued at £3,550, in 1921. Hides and skins are now more in demand, and exports have increased in value this year to £6,584, as compared with £4,946 in 1921. There is a difference of £8,402 in the value of tobacco exported during the three months of 1922 and that of last year. This disparity will in all probability be adjusted in subsequent returns, for the crop handled this year is considerably in excess of that of the previous season.

An Export Trade in Ground Nuts.—Mr. J. W. Downie, General Manager of the Farmers' Co-Op., Ltd., Salisbury, has made enquiries during his trip to Great Britain regarding the prospects of an export trade in ground nuts. The conclusion he has come to is that the export of ground nuts appears to offer as good prospects as the export of maize.

The following figures extracted from an analysis of ground nuts recently offering in Great Britain, and made at Mr. Downie's request, are therefore of interest:—

Rhodesian nuts	49.32	per cent.
Mozambique nuts	48.91	„
Nigerian nuts	48.86	„
Coromandel nuts	48.00	„
Mombasa nuts	46.00	„
Bombay nuts	45.50	„
Chinese nuts	44.45	„
Free of fatty acid in the extract of oil (as oleic)	.26	per cent.
Moisture	5.28	„

The quality of shelled nuts—a sample of which was taken Home by Mr. Downie—as shelled by a hand sheller is considered satisfactory, and he is of opinion that there should be a limited market for prime nuts for confectionery purposes. The ground nut referred to in the list is the Spanish Bunch, which is the variety now grown in Rhodesia almost to the exclusion of all others.

Mr. Downie also took with him samples of sunflower seed, which were analysed as follows:—

Rhodesian black sunflower seed, oil in pure sunflower seed	27.86	per cent.
F.F.A. in the extracted oil and as oleic ... ..	.66	„
Moisture	5.33	„
Rhodesian striped sunflower seed, oil in pure sunflower seed	25.93	„
F.F.A. ... ..	.68	„
Moisture	6.09	„

The black variety primarily is used for oil extraction, and the striped is more popular for poultry feed.

Rhodesian Milk Records.—Elsewhere in this issue will be found the records received to date of cows entered for the milk recording scheme which has been in operation since last August. The season has been abnormal, but the number of entries received has been satisfactory, and those pioneers of scientific production who have sent in returns deserve every credit for their enthusiasm in face of most trying conditions.

The most outstanding cows in the returns are "Brakfontein Aggie," owned by Messrs. Renniker and Rettie, Salisbury, which has produced 3,871.75 lbs. in 120 days, or an average of over three gallons per day; and "Bell," a Friesland cow, owned by Mr. J. Struthers, of Sinoia. This cow has produced 770 gallons in seven months, or approximately four gallons per day, testing on an average 3.72 per cent. butter fat. "Bell" was bred by the owner, who has been testing his herd consistently for the past nine years. That milk recording pays, and pays handsomely, is proved by this return, and also by the amazing prices realised by the South African bred Frieslands at Slough.

Mr. Holt Thomas, the President of the British Friesian Society, at the sale dinner made some remarks which are so apt that we can be forgiven for quoting from the report of the speeches made on that occasion:—

"It was by breeding from a strain that had proved itself that they eventually arrived at herds averaging 1,000, and even 1,200 gallons or more, and that was where the pure-bred Dutch cow came in, and that was why the South African importation was so important. Old-fashioned methods were bound to go, and, whether in the factory or in the cow shed, high production was the only thing that paid. The two-gallon cow cost just as much in overhead charges as the five-gallon cow, and looking to the future, it was safe to say that it was only the big producer which could pay the rent."

Mr. Holt Thomas went on to say that "without type and ancestry they could not necessarily breed right or breed milkers. Simply to take a heavy milker which with the next calf might throw back to another ancestry was no good, and it was type they wanted to-day. . . . The stipulation made by the Minister for Agriculture was that the dam of each animal imported from South Africa must have produced not less than 1,200 gallons of milk in not less than 300 days, and that such milk should have a butter fat content of 3.3 per cent. As a matter of fact, the dams of the South African cattle averaged 1,432 gallons of milk, with a butter fat percentage of 3.48."

It is not many years ago since the number of breeders in the Union who kept milk records could be numbered on the fingers of one hand. It is interesting to note that the top prices were gained by this small band of enthusiasts, amongst whom the Hon. Joseph Baynes, Mr. Arthur Kingwell, and Mr. Abrahamson were outstanding figures. It is to be hoped that Rhodesian breeders of milk cattle will follow their example, and by keeping records raise the standard of milk production in this country.

Trout in Rhodesia.—Our readers will be aware of the movement initiated last year for the introduction of trout into the rivers of Southern Rhodesia, and will be interested to know what progress is being made. The Rhodesia Trout Acclimatisation Society was formed on the 4th June, 1921, and the membership to date numbers 100 odd. The society is desirous of enrolling every pisciculturist and angler in the country, and cordially welcomes applications for membership; the fee for which is only 10s. 6d.

Thanks to the generosity of one of the society's members, a number of ova were donated to the society last year, and were hatched out at the Government laboratory at the time of the Salisbury Agricultural Show. Subsequently some 1,300 young trout were liberated in the Cleveland Dam. It having been found, after extensive enquiries, virtually impossible to obtain ova in any quantity from the Union, enquiries are now being made in England and New Zealand with a view to obtaining further supplies. The matter of breeding ponds and hatching locally is being considered by the executive committee. The society is also considering the possibility of netting certain Rhodesian streams into which trout were placed some years ago, and thus obtaining parent fish for breeding purposes.

Executive committees have been appointed at Selukwe and Umtali. Thermometers have been issued to members in various districts with requests to report on the temperatures of rivers.

The Tobacco Industry.—The seventh annual report of the Rhodesian Tobacco Co-operative Society (Reg.) presented to the annual general meeting of the society, held in Salisbury on the 20th June, contains several items of public interest.

The membership of the society now numbers 203, and includes practically every individual tobacco grower in Southern Rhodesia. During the year under review the society handled 3,038,030 lbs. of Virginia tobacco, which was an increase of 1,090,588 lbs. as compared with the previous year. Of the amount handled, 945,240 lbs. was graded and prepared for market on the farms.

The total weight of tobacco sold to the end of the financial year was 2,150,259 lbs. Of this quantity, the United Tobacco Company purchased 949,985 lbs. and Mr. M. Pevsner 1,200,274 lbs. The actual sales value of the tobacco was £95,913 10s. 6d. At the end of the financial year the society had on hand 887,771 lbs. of ungraded tobacco, valued at £24,687 13s. 10d. The total value of the Virginia tobacco handled by the society was therefore £120,601 4s. 4d.

The report gave analyses of the various grades of tobacco handled and the cost of operating the warehouse. Attention was drawn to the continued high percentage of inferior tobacco produced, and growers were warned of the danger to the industry in this connection. Tobacco growers should realise the serious consequences to themselves and to the industry as a whole which will result from the continued production

of low-grade leaf, and should endeavour to produce tobacco of better quality, even if this should result in a decrease in the total amount produced.

A number of resolutions of great importance to the tobacco industry were adopted, among which were the following:—

“That charges for working expenses on ungraded tobacco be levied at a uniform price per pound, and to be included as one of the society's rules.”

“That this meeting is of opinion that all members of the society should sign an undertaking to send all their tobacco to the society for a period of five years.”

The undertaking was worded as follows:—“We, the undersigned members of the Rhodesian Tobacco Co-operative Society, hereby promise and undertake, for a period of five years, to deliver all Virginia tobacco produced by us to the said co-operative society, in terms of the rules and regulations thereof.”

On the question of farm grading, it was resolved, “That it be a recommendation to the board that after the present season no tobacco be received at the warehouse unless fully graded.” The meeting discussed the question of an experimental farm for tobacco, and unanimously passed a resolution, “That the board be asked to approach the Agricultural Department with a view to having a tobacco experimental farm started.”

The following members were elected as directors for the ensuing year:—Messrs. W. T. Hall, H. K. Bracewell, R. G. Garvin, C. J. Keighley, G. H. Walker, R. P. Jenkin and Captain F. Smith. At a board meeting held the following day, Mr. R. G. Garvin was unanimously elected chairman of the board.

Irrigation Loans.—Attention is drawn to Government Notice No. 316 which is printed at the end of this *Journal*. It will be noted that the Government have decided to set aside an amount of approximately £5,000 for the purpose of granting loans for irrigation works. The method of applying for a loan is detailed in Form “A L” which is printed as an appendix to the notice.

The need for these loans has long been felt, as many promising irrigation schemes have been held up for lack of funds.

Sunn Hemp Seed from Rhodesia.—The following extract is taken from the Bulletin of the Imperial Institute, vol. xix., No. 4:—“Seed of *Crotalaria juncea*, the plant which yields the fibre known as sunn-hemp, was received from Rhodesia in January, 1920. It was stated by the Director of Agriculture, in forwarding the seeds, that the plant grows freely in Rhodesia and promises to be of great value in rotation.

It may, perhaps, not be possible to recommend it to be grown as a fibre crop, but if the plant and seed could be used with safety as fodders, this would do much to popularise it in the country.

"The seeds were small and flat, about $\frac{1}{4}$ in. long, mostly varying in colour from greenish to dark bluish grey. They were analysed with the following results:—

	Per cent.
Moisture	8.6
Crude proteins	34.6
Consisting of—	
True proteins	31.2
Other nitrogenous substances	3.4
Fat	4.3
Starch, etc. (by difference)	41.1
Fibre	8.1
Ash	3.3
Nutrient ratio	1:1.5
Food units	138

"The seeds did not contain any cyanogenetic glucosides, but a substance was present which gave re-actions similar to those of alkaloids, and it might therefore be dangerous to use the seeds as a feeding stuff. The seeds of allied species of *Crotalaria*, e.g., *C. retusa*, *C. sagittalis* and *C. striata*, contain an alkaloid which is probably cytisine, a highly toxic substance.

"Sunn hemp seeds contain a large percentage of proteins, but they do not appear to be generally used as a feeding stuff for cattle, although it has been stated that in some parts of India they are employed for this purpose.

"In view of the possibility that the seeds contain a poisonous alkaloid, it was pointed out that careful trials would be necessary before they could be recommended for feeding cattle. Acting on this suggestion, preliminary feeding trials have been conducted by the Department of Agriculture. The results seem to indicate that the seed is harmless to sheep when fed in small quantities, but that it is not suitable for use in large quantities. No ill effects were noticeable when $\frac{1}{4}$ lb. of the crushed seed, mixed with crushed maize, was fed to a sheep daily for a fortnight, but when double this quantity was given, the sheep began to show signs of partial paralysis and general indications of poisoning, and after ten days it died. The sunn hemp seed was objectionable to the sheep, and therefore not eaten readily.

"Feeding experiments with the sunn hemp plant as green fodder have also been conducted in Rhodesia. Two merino ewes were given quantities up to 2 lb. per head per day, but throughout the experiment great difficulty was experienced in getting them to eat it, and at no time did they eat more than $\frac{1}{4}$ lb. per head per day. The experiments were continued for about sixteen weeks, and neither ewe at any time showed any ill effects from the diet, so that, even if injurious, the green fodder is apparently not acutely poisonous."

Experience has shown that sunn hemp will make a strong growth on even the poorest of Rhodesian soils. It is a very quick grower and an excellent weed smotherer. In normal seasons it will reach a height of $2\frac{1}{2}$ to 3 ft. within six weeks to two months of being sown. This fact is of great value in a green manure crop, enabling it either to be sown early, ploughed in and followed by a catch crop sown in January, or, if preferred, sown late after all other sowings are completed and yet turned under while the land is still moist.

If it could safely be used as a feed crop its value would be still greater. At the present time a feeding trial with the feed is being carried out on a bullock at the Gwebi experiment farm, but though the crushed beans are mixed with other succulent and concentrated feeds, great difficulty is experienced in getting the beast to take the diet freely. As far as is known, there are no instances of farm stock feeding on the growing crop, but after the stems have been cut, cattle will pick up and eat the wilted and fallen leaves and such seed as may have shed without any injurious effects.

Pig Breeding in Rhodesia.—A meeting was held at Gwelo during the recent show of those interested in pig breeding in this Territory. It was pointed out that Ordinance No. 9 of 1921 precludes the formation of a separate organisation for Rhodesia, and provides that only one society, i.e., the Pig Breeders' Society of South Africa, can be recognised for the registration of the pedigree of pigs. This, of course, bars the formation of a purely Rhodesian Pig Breeders' Society as a separate entity. There is, however, no reason why a Rhodesian branch or committee of the existing society should not be formed, for which provision is made by the following clause in the constitution of the South African Pig Breeders' Society:—

"The members of the society residing in any province or territory shall have power to elect a committee for that province or territory, which committee shall act as a local committee for that province or territory concerned, and shall be empowered to convene meetings of members to discuss matters of particular or general interest connected with the pig breeding industry."

A meeting of those interested in pig breeding will be held on Thursday, 10th August, at the Show Ground, Salisbury, with a view to electing a Rhodesian committee of the society. It is hoped there will be a good attendance.

Statistics of Live Stock and Animal Products

FOR THE YEAR 1921.

By H. C. K. Fynn, Acting Statistician.

It was hoped that it would be possible this year to publish the live stock report for 1921 in an earlier number of this Journal. This was found to be impracticable, owing to dilatoriness on the part of those who should have sent in returns, necessitating the issue of numerous reminders, which, however, led to such satisfactory results that the figures relating to live stock in the appended returns may be regarded as approaching a high degree of accuracy. The same, however, cannot be said of the returns of animal products, poultry, etc., which leave much to be desired. While the majority of stock owners spared no labour and trouble in ascertaining and recording on the returns the exact amounts of their sales of milk, cream or butter fat, butter and eggs, there were others who merely estimated or omitted the figures altogether. The attention of those concerned is once more directed to the necessity for greater care and accuracy in furnishing the data of sales of animal produce in future returns. Our statistics of production are studied in all parts of the civilised world, hence it should be the object of every stock owner to assist in this important work by giving in his return full and complete information. Napoleon once said that "an army moves on its stomach"; similarly, a country may be said to stand on its statistics of production, so far at any rate as its borrowing capacity is concerned.

During 1921, and subsequently, the names of 380 new land owners or occupiers have been added to the directory of farmers and ranchers. Of these, 26 are war settlers who acquired land by the advice and assistance of the War Settlement Board. Many others with military titles are evidently ex-service officers who acquired land through other channels. Another new and growing feature is that the sons of established farmers and other residents are now engaging in farming operations on their own account.

The total number of live stock returns received is 2,427, which may be taken as representing the total number of stock owners in the Territory, as only six returns have not been accounted for.

The number of cattle ranches proper at the end of 1921 was 96, of which 56 are in Mashonaland and 40 in Matabeleland. This does

not include farms on which extensive mixed farming operations were being undertaken, although heavily stocked.

Thanks are due to the Police and to Cattle Inspectors who furnished the Statistician with the names of many unrecorded stock owners, and thus to a great extent assisted in the attainment of the high degree of accuracy attending our enumeration on this occasion.

The following is a classification of owners of 500 head of cattle and upwards:—

Over 500 but under 1,000.	Over 1,000 but under 2,000.	Over 2,000 but under 3,000.	Over 3,000 but under 4,000.	Over 4,000 but under 5,000.	Over 5,000 but under 10,000.	Over 10,000 but under 20,000.	Over 20,000 but under 40,000.	Over 50,000.
236	59	22	3	6	4	4	1	1

The number of owners of over 1,000 head of cattle is just 100, over 500 head 336, and under 500 head 2,091 persons.

CATTLE.

The total number of cattle owned by Europeans is shown as 908,646, an increase of 135,755 over the 1920 figure of 772,891, or a difference of 17.5 per cent. The native-owned cattle according to statistics furnished by the Native Department number 854,498, an increase of 110,096 over the 1920 figure of 744,402, or 14.7 per cent. This makes a grand total at 31st December, 1921, of 1,763,144, the gross increase being 245,851 head, equal to 16.2 per cent.

The relatively high rate of increase this year has been brought about by five separate causes, all tending in the same direction; first, the somewhat low figure of calving last year, followed not unnaturally by a recovery owing to cows which missed last year coming into profit again; second, the favourable season; third, the diminishing death rate owing to general freedom from disease, particularly in regard to calves; fourth, the reduced outlets preventing the normal flow of cattle to market; fifth, to some extent the collection of returns has during the year been made more complete, and a certain number of cattle brought to account which in the past perhaps escaped notice. This is a small item, but with those enumerated above has its effect on the cumulative total.

The falling off of the demand in the south for slaughter cattle from this Territory is causing anxiety, as it is fully realised that in the absence of local freezing works, no other outlets exist at present for the rapidly accumulating quantity of live stock.

The average composition of the European-owned herds is of interest, as shown by the proportion of each class to the whole:—

COMPOSITION OF EUROPEAN-OWNED HERDS.

	1920.	Per cent.	1921.	Per cent.
Cows and heifers over 1 year	365,835	47.3	420,159	46.2
Heifers under 1 year ..	96,889	12.5	113,699	12.5
Total females ...	462,724	59.8	533,858	58.7
Stud bulls	9,809	1.3	11,108	1.2
Other bulls and bull calves ..	82,179	10.6	82,760	9.3
Trained oxen	80,399	10.4	89,556	9.8
Other oxen	137,780	17.9	191,364	21.0
Total males. ...	310,167	40.2	374,788	41.3

The proportion of males, and especially of oxen, is steadily rising owing to the diminishing export in the face of increasing totals.

Owing to the growing practice among stock owners of castrating their bull calves at an early age, the difficulty arose when filling in the stock returns as to what heading these "tollies" should be entered under; whether as "other bulls and bull calves" or as "untrained oxen." Some undoubtedly entered them under the former, and others included them with untrained oxen, while quite a few put in a heading of "Tollies," and in several cases they were entirely omitted. Other than bulls, trek oxen and calves, all the rest are untrained oxen.

Stud bulls number about 1 to 48 females. The ratio of European-owned to native-owned cattle is 51.5 to 48.5.

Exports.—The total number of cattle exported during the year was 12,348, of which 7,964 were for slaughter, 3,982 for breeding purposes and 402 trek oxen. Fuller details are given in Appendix A.

Imports.—From the United Kingdom, 36 bulls and 22 cows and heifers, totalling 58; and from the Union, 592 bulls and 357 heifers, totalling 949, making a grand total of 1,007 importations for the year, compared with 961 in 1920, of which 789 were from the Union and 172 from the United Kingdom. Some of the bulls imported from the Union succumbed to gall-sickness soon after their arrival in Rhodesia.

The following returns, except where expressly stated to the contrary, refer to European cattle only.

APPENDIX A.—EXPORTATION OF CATTLE.

Country of destination.	Slaughter cattle.	Breeding cattle.	Trek oxen.
Union of South Africa	6,958	3,145	174
Northern Rhodesia ... ..	...	21	...
Belgian Congo ... ..	...	351	...
Portuguese East Africa	1,006	465	228
Totals	7,964	3,982	402

Pure-bred Cattle.—The need of pure-bred bulls is recognised, and so far as may be farmers are obtaining and using such. To-day one-sixth of the bulls in use on European farms are pure-bred and the rest are grade, largely high grade, no native bulls being employed. This is a much better state of affairs than was the case a few years ago, when pure-bred stock was the rare exception, but there is still room for improvement. According to the latest statistics—those for 31st December, 1921—there are 11,108 stud bulls in use, of which 1,857 are pure-bred of European breeds, and 849 are described as Africander.

The number of pure-bred European cattle, excluding Africander, has risen during the past three years successively from 5,075 to 5,698 and 6,851 head. This is important, since the numbers of grade cattle must be increasing more than proportionately and the quality of the grade rising.

After Africanders, returned as 1,897 head, we have 1,750 Shorthorns, next 1,210 Herefords, then 1,054 Devons, closely followed by 1,021 head of Frieslands. Last year the Herefords outstripped in numbers the Frieslands, and this year they have overtaken Devons, and as there have been notable importations lately, this breed bids fair in popularity ere long to rival the Shorthorn. Aberdeen Angus come next with 636 head, then three breeds close together—Sussex 369, Lincoln Red 354 and South Devons 326; the remaining Ayrshires, Red Poll and Jersey being still few in the country. Brown Swiss appear in the return for the first time with two representatives. The diminution in the number of pure-bred Africander cattle returned is due to the fact that several owners who in 1920 classed them as pure-bred did not so regard them in 1921. It is even probable that of the 1,897 returned as pure-bred this year, many would not be so regarded by a competent judge.

INCREASE OF CATTLE, 1916 to 1921

Year.	European-owned cattle.	Native-owned cattle.	Total cattle.	European cattle. Net annual increase per cent.	Native cattle. Net annual increase per cent.	All cattle. Net annual increase per cent.
1916	468,504	491,522	960,026	18.6	10.1	14.1
1917	532,311	551,632	1,083,943	13.6	12.2	12.9
1918	600,447	610,100	1,210,547	12.8	10.6	11.6
1919	678,508	652,776	1,331,284	13.0	6.9	9.9
1920	772,891	744,402	1,517,293	13.9	14.0	13.9
1921	908,646	854,498	1,763,144	17.5	14.7	16.2

The net average increase per cent. over five years 1917, 1918, 1919, 1920 and 1921 is, for European-owned 14.16 per cent., native-owned 11.68 per cent., and all cattle 12.90 per cent.

The following table shows the increase or decrease of all kinds of European-owned live stock for the year ended 31st December, 1921:

	1920.	1921.	Plus difference.	Per- centage plus.	Minus differ- ence.	Per- centage minus.
Cattle	772,891	908,646	135,755	17.5		
Horses	2,891	3,223	332	11.4		
Mules	2,496	2,393	.		103	4.1
Donkeys	9,116	10,066	950	10.4	..	
Sheep	43,844	52,944	9,100	20.7		
Goats	19,455	18,814	.		641	3.2
Pigs	17,761	26,672	8,911	50.1		
Poultry	109,394	159,109	49,715	45.4		

It will be observed that, with the exception of mules and goats, the numbers of which receded slightly, all classes of live stock show substantial increase, notably cattle, sheep, pigs and poultry.

EXPORTS OF ANIMALS—OTHER THAN CATTLE—IN 1921 BY COUNTRIES OF DESTINATION.

Class of animal.	Country of destination.	Number exported in 1921.	Number exported in 1920.
Horses	Belgian Congo	16	8
	Portuguese East Africa	26	45
	Union of South Africa	6	11
	Northern Rhodesia	42	60
Mules	Belgian Congo	10	16
	Portuguese East Africa	19	13
	Union of South Africa	3	8
	Northern Rhodesia	2	44
Donkeys	Belgian Congo	133	18
	Portuguese East Africa	9	62
	Northern Rhodesia	215	64
Sheep and goats	Belgian Congo	1,233	1,225
	Portuguese East Africa	279	797
	Union of South Africa	296	1,438
	Northern Rhodesia	698	455
Pigs	Belgian Congo	624	35
	Portuguese East Africa	210	2
	Union of South Africa	495	225
	Northern Rhodesia	125	12

Fewer horses, mules, sheep and goats were exported in 1921 than in 1920, while donkeys show an export increase of 213 and pigs an export increase of 1,180.

IMPORTS OF ANIMALS—OTHER THAN CATTLE—IN 1921 BY COUNTRIES OF ORIGIN.

Class of animal.	Country of origin.	Number imported in 1921.	Number imported in 1920.
Horses	United Kingdom ... ..	...	1
	Union of South Africa ..	1,495	1,705
Mules	Union of South Africa ...	397	771
Donkeys	Union of South Africa ...	679	970
Sheep and goats	Union of South Africa ...	28,533	16,101
Pigs	Union of South Africa ...	78	78

It may be observed that, with the exception of sheep and goats (imported mainly for slaughter) and pigs, the importations in 1921 were below those for 1920.

HORSES.

The number of horses which succumbed to horse-sickness during the year is unknown. The number imported was 1,495, which, added to those returned at 31st December, 1920, viz., 2,891, gives a total of 4,386, of which 90 were exported during 1921, leaving a balance of 4,296. The difference of 1,073 between this number and those returned as on farms, viz., 3,223, must be the number in the various townships, less an allowance for deaths.

The breeding of horses on the high veld during the year appears to have been successful.

MULES.

Few mules are bred in the country, our supplies being obtained from the south. Owing to the increasing use of motor cars on farms, fewer mules are required. The importations during the year were 397, as against 771 in 1920. The number exported was 34.

SHEEP.

The increase of sheep was normal. The relatively high increase shown in the returns is due to the inclusion of sheep for slaughter purposes with breeding stock grazing on commonages. The number imported from the Union during 1921 was 23,960, a large proportion of which were for slaughter. The number exported was 2,015.

The crossing of the native sheep with pure-bred Persian rams has proved successful, the progeny being hardy and in steady demand for slaughter.

Woolled sheep increased from 7,177 to 8,779 in 1921.

The natural pasturage cannot yet be regarded as generally suitable for this kind of sheep, apart from climatic conditions, which make the successful rearing of woolled sheep difficult in hot countries.

GOATS.

There was a slight decrease of 641 in the number of goats returned. The importations from the Union were 4,573, and the exportations 491. The native goat of this country is a very inferior animal, but wherever Boer goat rams have been introduced, the improvement in size and appearance is most marked. Wherever rainfall is not abundant, the goat thrives and multiplies rapidly, and is a sure source of profit to the owner, in spite of its destructive propensities where crops, ornamental trees and shrubs are concerned. Of milch goats, there are but few all told.

PIGS.

Pigs increased from 17,761 to 26,672, or 50.1 per cent. Breeding pigs to the number of 78 were imported from the Union. The exportations were 1,454 during 1921, as against 274 in 1920. The standard of the bacon pig is gradually improving, due to careful selection of pedigree sires. There is still, however, considerable scope for improvement in feeding and management in regard to pigs sent to the factories.

POULTRY.

Poultry also shows a substantial increase in numbers, viz., from 109,394 to 159,109 in 1921, or 45.4 per cent.

The following were the exports during the year:—

To Belgian Congo	169	head,	valued at	£152
To Portuguese East Africa	903	„	„	215
To Union of South Africa	71	„	„	93
To Northern Rhodesia	273	„	„	282
	1,416	„	„	£742

equal to 10s. 5d. each. These were evidently for breeding.

During the same period we imported from the United Kingdom 52 fowls, valued at £46, and from the Union 2,748, valued at £1,597.

The poultry industry has during the last few years made considerable advance, due in a great measure to egg-laying competitions and agricultural shows.

The above figures of exports show that local poultry breeders are already noted for the purity and high standard of their breeds.

ANIMAL PRODUCTS, 1921.

Eggs.—The eggs produced by farm fowls in 1921 show an increase of 69,731 dozens above the 1920 figure, equal to 48.4 per cent. With the improvements in breed taking place, there should be a corresponding increase in the output of eggs this year.

Exports.—The value of eggs exported in 1921 from Southern Rhodesia is given in trade statements as £1,084, and for 1920 as £1,838. The quantities are given in pounds weight, not in dozens.

Imports.—In the same statement above referred to, the value of eggs imported into the country is given as £4,023 in 1921 and £3,297 in 1920. It should be noted that the above valuations are those of the consignors in all cases, irrespective of what the eggs may have realised eventually. Several consignments from the Union had to be destroyed on arrival, being unfit for human consumption.

Cream.—Allowing two pounds of cream to one pound of butter fat, the quantity of cream sold during 1921 was equal to 833,507 lbs., as against 618,584 lbs. in 1920. But for the drought, this quantity may well have been larger.

Milk.—The milk sold was 4,351,485 lbs., an increase of 1,696,295 lbs. above the 1920 figure of 2,655,190, or nearly 64 per cent.

Butter.—The butter exported during 1921 was as follows:—

Exports.—

To the United Kingdom ...	142,576 lbs.,	valued at	£16,181
To the Belgian Congo ...	133,701 "	"	15,183
To Portuguese East Africa	49,033 "	"	5,193
To the Union of South Africa	65,490 "	"	6,641
To Northern Rhodesia ...	31,694 "	"	4,067
<hr/>			
Total ...	422,493 "	"	£47,265

as against 205,098 lbs., valued at £29,312, in 1920, less in quantity by half the above figure.

Imports.—The butter imported during 1921 was:—

From the United Kingdom ...	24 lbs.,	valued at	£6
From Australia ...	456 "	"	83
From the United States of America	14 "	"	1
From the Union of South Africa	84,003 "	"	8,279
<hr/>			
Total ...	84,497 "	"	£8,369

as against 51,398 lbs., valued at £6,415, in 1920.

The explanation of the importation of 84,003 lbs. of butter from the Union in the face of an export of 65,490 lbs. to the same country is, briefly, the result of trade competition between rival firms in this country, added to over-export when our supplies were at their height, followed by a scarcity when local supplies diminished, necessitating import.

TABLE II.

[illegible]

TABLE I.

District.	Cattle.							Horses.	Mules.	Donkeys.	Sheep.		Goats.	Pigs.	Poultry.
	Total.	Cows and Heifers over 1 year old.	Heifers under 1 year, including Heifer Calves.	Stnd Bulls.	Other Bulls and Bull Calves.	Trained Oxen.	Other Oxen.				Merino.	All other.			
Wankie	9,189	4,390	1,109	88	863	1,076	1,633	20	27	84	...	312	74	312	2,159
Nyamandhlovu ...	14,674	6,341	1,677	128	1,661	1,967	2,900	57	26	223	...	913	526	544	2,996
Bulalima-Mangwe ...	35,124	16,879	4,456	365	3,763	2,422	7,209	210	44	668	250	2,494	1,308	1,843	9,472
Matobo	17,301	8,237	2,215	280	1,854	1,163	3,762	90	95	537	288	1,146	390	746	2,769
Umzingwane	12,199	5,850	1,519	106	1,622	1,077	2,025	54	31	266	8	1,440	204	370	3,125
Bulawayo	11,988	5,702	1,466	120	1,100	1,681	1,899	134	315	664	100	1,129	246	406	9,507
Bubi	37,646	17,656	4,175	408	3,376	3,169	8,862	106	63	714	...	2,247	1,030	1,122	4,346
Sebungwe	298	72	29	2	30	101	64	4	...	14	...	51	...	165	20
Gwelo	83,680	41,696	10,924	1,129	9,765	8,018	11,948	279	187	837	1,498	5,482	961	2,492	17,254
Selukwe	18,581	8,411	2,102	262	1,896	2,288	3,622	71	52	84	137	552	304	1,130	3,149
Insiza	51,334	21,219	7,018	596	6,498	2,587	13,416	176	90	456	150	4,334	836	838	4,627
Gwanda	50,222	26,066	4,162	729	1,006	923	17,346	79	46	301	...	380	236	335	1,839
Balingwe	24,519	10,898	3,150	232	2,664	2,714	4,861	73	51	232	...	961	302	233	1,462
Victoria	36,219	16,627	5,003	394	3,562	3,529	9,104	112	37	550	56	2,183	1,005	600	4,548
Chilimanzi	35,889	18,244	4,042	561	3,668	2,657	7,317	111	40	381	96	1,626	238	642	4,167
Hartley	68,472	31,404	8,929	862	7,709	6,793	12,775	148	85	474	392	2,652	1,394	1,496	12,404
Lomagundi	30,331	18,061	4,713	414	3,721	6,818	5,604	58	118	141	141	1,502	1,202	1,778	8,034
Mazeo	51,275	19,881	6,238	503	3,873	14,377	7,403	216	286	245	138	2,203	533	3,138	10,807
Salisbury	49,910	21,588	5,740	395	4,815	8,501	8,871	168	329	883	197	2,527	580	2,617	16,457
Marandellas ...	33,958	17,124	3,969	420	3,660	3,160	5,625	94	41	121	...	766	296	936	6,041
Charter	34,961	17,063	5,036	491	2,598	3,753	6,020	291	97	606	536	1,849	972	857	7,778
Gutu	17,006	7,965	2,181	251	1,946	1,128	3,535	34	11	67	4	717	235	441	2,267
Ndanga	8,468	4,812	1,266	163	816	632	1,779	24	11	68	...	189	113	81	542
Chibi	68,748	28,281	10,340	892	262	815	28,152	26	33	7	20	...	10	13	140
Bikita	2,633	1,148	420	21	383	222	439	1	12	...	...	...	...	3	345
Melsetter	24,133	11,899	3,536	362	2,664	1,306	4,666	241	73	767	2,906	4,198	3,336	1,030	5,325
Umtali	24,903	11,868	3,427	378	2,374	2,556	4,300	146	166	279	844	1,016	1,702	976	6,098
Makoni	28,727	14,553	4,140	376	3,510	3,016	4,130	153	56	171	172	761	533	971	7,809
Inyanga	4,846	1,940	704	66	501	471	664	16	20	132	846	322	118	114	854
Mrewa	4,768	2,131	687	48	571	719	602	15	9	61	...	134	42	330	1,407
Mtoko	2,625	954	228	16	78	175	574	1	1	3	...	...	...	...	25
Darwin	2,159	997	282	20	251	342	267	15	1	48	...	80	88	113	286
Totals	908,646	430,159	113,699	11,108	82,760	89,556	191,364	3,223	2,398	10,066	8,779	44,165	18,814	26,672	169,109

TABLE III.

District.	Animal Products sold, 1921.							Wagons.			
	Eggs. doz.	Cream.		Milk. lbs.	Butter. lbs.	Cheese. lbs.	Wool. lbs.	Ox.	Mule.	Donkey.	Scotch Carts.
		Sold as Butter Fat. lbs.	Sold as Cream. lbs.								
Wankie	8,008	...	4,877	119,820	13,512	...	...	20	1	2	3
Nyamandhlovu	4,478	1,280	8,021	1,180	6,940	4,158	...	42	5	5	4
Bulalima-Mangwe	15,698	34,654	43,079	39,455	2,122	1,650	..	65	9	13	6
Matobo	4,937	8,487	4,029	242,230	7,002	...	...	29	7	16	5
Umzingwane	4,285	10,716	5,013	68,240	12,406	...	...	20	1	3	2
Bulawayo	19,260	13,537	12,469	702,670	7,491	1,888	150	42	57	148	...
Bubi	6,545	20,330	78,955	103,895	11,487	..	..	91	4	17	1
Sebungwe ... ..	...	...	...	...	...	...	...	5	...	...	...
Gwelo	22,809	41,901	63,926	187,749	21,897	212	7,101	156	18	22	12
Selukwe	2,265	4,407	1,187	68,416	3,613	...	..	82	3	4	5
Insiza	8,262	14,056	17,024	460	5,874	..	700	45	8	14	4
Gwanda	586	5,515	2,400	8,980	2,232	500	..	13	3	5	1
Belingwe	535	...	...	8,160	1,269	..	..	33	..	3	3
Victoria	4,424	4,294	3,658	38,690	6,540	515	..	90	4	18	2
Chilimanzi	3,672	12,979	3,491	43,580	5,092	...	..	48	3	3	4
Hartley	17,081	15,438	13,828	477,414	2,663	20,005	..	155	13	28	6
Lomagundi	8,251	13,842	30,154	42,387	10,351	305	..	133	7	5	8
Mazoe	8,618	13,288	5,429	58,630	12,033	...	..	238	39	11	8
Salisbury	18,814	8,421	16,792	1,446,961	55,164	1,262	800	178	64	39	13
Marandellas	17,133	3,202	4,628	9,580	11,546	3,100	156	85	5	2	...
Charter	5,451	9,152	20,159	15,950	6,832	...	..	71	3	11	2
Gutu	1,149	2,208	2,682	500	778	..	..	21	1	1	1
Ndanga	8	200	...	...	...	..	..	14	..	1	...
Chibi ... ..	...	...	...	...	...	..	..	17	..	..	...
Bikita ... ..	...	...	...	...	...	..	..	4	..	..	2
Melsetter	2,146	150	...	5,672	5,333	1,760	..	23	4	23	...
Umtali	15,904	40	...	526,635	19,838	500	2,500	78	11	11	5
Makoni	11,408	5,662	6,168	134,201	18,897	5,919	...	79	3	3	2
Inyanga	498	...	...	...	592	...	3,000	12	1	4	2
Mrewa	1,475	...	50	...	3,310	...	..	18	2	..	..
Mtoko ... ..	...	...	...	...	...	...	..	7	1	...	4
Darwin	100	...	...	...	284	...	...	8	...	1	..
Totals	213,778	243,759	345,969	4,351,485	255,104	41,854	14,407	1,922	277	413	105

Cheese.—The manufacture of farm cheese during 1921 was 41,854 lbs., as against 33,457 lbs. in 1920, an increase of 8,397 lbs. When it is realised that cheese to the value of £10,280 was imported in 1921 from the Union, one wonders why farm cheese is not made on a far larger scale in this country.

The importations of cheese in 1921 are tabulated hereunder:—

From the United Kingdom	158 lbs.,	valued at	£19
From Australia	739	„ „	45
From Holland	71	„ „	13
From Italy	152	„ „	29
From the Union of South Africa	127,794	„ „	10,280
<hr/>			
Total	128,981	„ „	£10,402

A moderate proportion of this cheese was re-exported, and the exports for the same period were:—

To the Belgian Congo	5,310 lbs.,	valued at	£577
To Portuguese East Africa	13,291	„ „	1,148
To the Union of South Africa ...	10,945	„ „	929
To Northern Rhodesia	5,455	„ „	551
<hr/>			
Total	35,001	„ „	£3,205

Wool.—The quantity of wool sold was 14,407 lbs., which is much the same as the 1920 figure of 14,088 lbs.

Common Defects in Butter Making.

By T. HAMILTON, M.A., N.D.A., N.D.D., Dairy Expert.

The true flavour of high-class butter is very difficult to define. It should be pleasing to the palate, and should leave the delicate, nutty, full flavour of cream in the mouth. Defects in flavour are variously described, but those most common other than good can be described as insipid or flat, stale, fishy, cheesy and curdy, yeasty, bitter, mouldy or musty, and rancid.

Insipid or Flat Flavour.—This is one of the commonest defects of butter. It is due to a variety of causes, the chief being the lack of succulent or green feed, especially in the winter, the maintaining of the cream at too low a temperature whilst ripening, and, lastly, the excessive washing of the butter whilst in the granular stage. Quite frequently butter is penalised for flavour because of a deficiency in salting. Salt in moderate and correct proportions always brings out the delicate flavour and improves the appearance of the butter by deepening the colour.

Butter made from unripe cream is often classed as insipid, as the popular demand is for a full-flavoured butter. The full flavour and aroma are usually brought out by ripening the cream for two or three days in summer and from four to five days in winter.

Stale Flavour.—This is usually due to the cream being churned whilst in an over-ripe or stale condition, or it may be caused by the use of cream for butter-making obtained from the milk of cows far advanced in lactation. A more frequent cause, however, is the use of rusty cream receptacles, such as petrol and paraffin tins. The use of these as cream containers is only too common, and bad results follow, as the acid very quickly eats away the thin coating of tin. Paraffin tins are most unsuitable vessels for cream ripening, and their use cannot be too severely condemned. A "fishy" flavour is often the result of this treatment. This flavour may not develop immediately, but if the butter is stored for any length of time its development is unfortunately certain.

Cheesy and Curdy Flavours.—These flavours are generally due to the decomposition of the proteid matter (derived from butter milk) retained in the butter because of faulty washing. This, especially, is a defect common during the summer, when it is almost impossible to make butter on the farms without the use of ice. If such butter is maintained at ordinary summer temperatures, the flavour goes "off".

in two or three days, and if stored any length of time becomes absolutely obnoxious.

To avoid the development of this cheesy flavour, it is necessary to use all available means to get the cream and the washing water as cool as possible. Placing the cream in a flat enamelled dish and exposing it and the washing water to the night air often has the effect of bringing down the temperature to 60 degrees. At this temperature, if churning takes place early in the morning, a reasonably good grain can usually be obtained and the butter milk washed out. The cream must obviously be kept overnight in a safe place which animals or fowls cannot reach. Under ordinary circumstances it should be placed under a rough cage made of half-inch netting and placed on an open verandah.

Cheesy butter is often full of white specks. These are particles of casein which are incorporated in the butter either through neglecting to strain the cream when it is put into the churn or by overchurning the butter. In this latter case it is obviously impossible to get rid of the butter milk and portions of hardened casein by washing.

Yeasty Flavour.—This is not a common defect in butter made on the farm, because the cream is not kept long enough to allow of yeasty fermentation to develop, but a yeasty flavour in cream sent to the creamery is common enough during hot weather. Such cream is always classed as third-grade, for it is impossible to make any other grade but cooking butter from it.

The fundamental cause of yeasty and foamy cream is the presence in cream of yeast cells. During December and January these yeast cells increase and multiply, gaining the ascendancy because conditions of high temperature are suitable for their development. When on the farm or in transit to the creamery the cream is maintained at a high temperature, the development of the yeast cells becomes very pronounced. It is, of course, often accompanied by the development of gas, and this either causes the lids of the cream cans to blow off or the cream to froth over. This is a common sight at almost any of our railway sidings or stations during the hot summer months. As yeasty cream is a seasonal phenomenon occurring almost solely during the summer months, it is obvious that high temperatures are the principal cause. It is, therefore, necessary to cool the cream as soon as separation is complete, and to keep the cream cool pending its despatch to the creamery or its manufacture into butter. This treatment cannot be too often emphasised, as it is the secret of successful cream production in every country and under every condition.

Another fruitful cause of yeastiness in cream is an unclean separator. Too much is left to natives, and the writer has frequently seen cases where the separator has not been properly cleansed after separation is complete. In one case the only cleansing which it received was half a pailful of luke-warm water allowed to run through the separator bowl. When taken apart, the bowl was found to be in an absolutely filthy condition. Such a separator would cause any cream, however treated, to be absolutely unfit for making into a first-grade butter.

Bitter Flavour.—This flavour has been noticed very frequently when droughty conditions were prevalent. At these times cows are usually to be found grazing in the vleis where the herbage is usually of a rank, sedgey nature. This grazing causes bitterness in the milk and cream, and may cause other phenomena, such as the curdling of the milk within one or two hours after being drawn from the cow. Perhaps, however, the commonest cause of bitterness in butter is the use of impure salt containing comparatively large amounts of magnesium and calcium compounds. Most of the Colonial salt is of this nature, and where butter is made for storing, either on the farm or in the factory, nothing but imported salt should be used.

Mouldy or Musty Flavour.—The formation of mould can be easily prevented by observing the precaution of keeping the cans of cream covered over with a piece of butter muslin pending its manufacture into butter or its despatch to a creamery. Cream at all times should be kept in a cool, airy place. Too many dairies in this country are used for other purposes than that of storing cream. Harness, saddlery, meat, bacon, potatoes or dirty sacks are often stored in the "dairy," and as often as not the walls are deficient as regards white-wash. Any dark, dusty, unventilated place is conducive to the formation of mould. There have been quite a number of cases brought to the notice of the writer where butter stored in such a dairy, especially in the warmer months, has developed red, green and black moulds, which give the butter a most unsightly appearance. If the dairy is kept thoroughly clean and the walls whitewashed frequently, no mould will develop. Often the cause is the use of cheap unsuitable boxes for butter, such as soap boxes, whisky boxes, etc. If these boxes are at all damp or kept in a damp place for any length of time, mould is almost certain to develop.

Thick inferior butter paper is another frequent cause of mould. When such paper is used it is frequently necessary to moisten the paper before wrapping the butter. In this case it is advisable to use the following solution. Take half a pound of boric acid and dissolve it in half a gallon of boiling water. When cool enough, put the clear solution into clean bottles and keep corked up. Dilute the concentrated clear liquid with twice its own volume of water, and wet the butter paper with the solution. The boric solution not only tends to help the butter to keep in good condition, but generally it prevents the formation of mould.

Another frequent cause of moulds is the wrapping of damp cloths round butter with the idea of keeping it cool. If these cloths are not removed, within a comparatively short period black spots of mould will appear. When butter is meant to be stored, the paper should be put on dry and the butter should be kept in as dry and cool a place as possible.

Rancid Flavour.—This is usually to be found in butter which has been stored for some time, although badly made and badly stored farm butter made in the hot weather often turns rancid within a week. In India butter, because of high temperature and bad water, becomes rancid very quickly, and for cooking purposes especially it is the

custom to melt the butter and pour off the clarified butter fat, which is known as "ghee." That the heat destroys the germ life present in the butter is obvious, so that if we can, by good treatment of the cream and by careful washing, eliminate as far as possible all germ life and nitrogenous matter, we should be able to make butter which, if not exposed to the air and to variations in temperature, will keep sweet for a very considerable period. As an experiment, a case of New Zealand butter made from pasteurised cream was kept for ten years in cold storage in London. When the butter was opened up last year it was found to be still quite sound. Pasteurisation had destroyed all germ life, the butter had been properly churned and washed, and its keeping qualities had been thereby ensured.

Defects in Flavour of Export Butter.—In this connection a quotation may be made from a valuable report on South African dairy produce in London, written by Mr. E. G. Hardy, Assistant Superintendent of Dairying in the Union. Mr. Hardy took the opportunity whilst in England of examining numerous cases of South African butter exported to the English market, and writes as follows:—

"Pasteurisation of the cream at the factory and the ripening of same with an active, pure culture starter would undoubtedly enormously enhance the keeping qualities of our butter, and would also help to bring about a more pronounced choice butter flavour in our butter. I was very greatly impressed by the New Zealand and Australian butters I saw in London, which had been made from pasteurised cream, and particularly with their wonderful keeping properties. I examined a case of New Zealand butter, manufactured in 1914, which was still quite sound in flavour, and apparently as good as the day it was made. Our creameries will have generally to adopt pasteurisation if we are successfully to compete in the London market.

"I am not, however, in favour of every creamery in the country immediately going in for pasteurisation. What I would suggest is, that some of our larger creameries or creamery groups undertake comprehensive experiments on a commercial scale.

"Another common fault observed in our butter was what is described by the trade as 'toppiness,' which is the development of an objectionable bitter flavour on the outside surface of the butter; it does not penetrate deeper than about half-an-inch, but when the affected part is removed the new surface exposed very quickly develops the taint. This fault was naturally most in evidence with butter packed in pats. Apart from the fact that pats do not keep as well as butter packed in bulk, the London market does not require them; pats will invariably realise a lower price than bulk butter of similar quality.

"Turning now to the flavour of our second and third-grade butters, I found the principal faults were 'fishiness' and staleness. 'Fishiness' is a most objectionable flavour which butter at times acquires, and has given trouble in all butter-producing countries. The direct cause does not appear to be definitely known, but the consensus of opinion is that it is due to an organism which, acting on the fatty acids of the butter, produces a chemical with a strong flavour and smell of fish oil. The

source of the infection is generally thought to be uncleanness and dirty handling of the milk or cream, or through the use of old rusty cans which cannot be kept properly clean; or it may even be through unclean conditions in the creamery or cold store. Storing at very low temperatures tends to check development of fishiness, but the most effective preventive is pasteurisation of the cream. As regards staleness, this was perhaps not more pronounced than was to be expected of stored butter of this class."

Defects of Body and Texture.—Properly made butter has a firm "body" and a consistently waxy texture. When the butter is first formed in the churn it makes its appearance in the shape of minute irregular granules. In the subsequent process of manufacture, if the butter is properly made, these granules never completely lose their individuality, and they constitute the so-called granular appearance which appears when the butter is broken. The more distinct the granules, the better the texture. When the butter is cut, no particles of fat should adhere to the knife.

Weak Body.—This is a common fault of butter made in the warmer season of the year, but even in the winter weak-bodied butter, because of overworking, is only too common. The fundamental cause of a weak body is neglect to cool the cream adequately previous to churning. Butter fat is composed of a mixture of fats of different melting points, and it is obvious that although some of these fats may be chilled, yet other constituents of the butter fat may be in a semi-liquid state. It is these semi-liquid fats which cause a weak-bodied butter. If this defect is to be avoided, it is essential to hold the cream at a low temperature for some considerable time. Rapid cooling to churning temperature and immediate churning is ineffective and is the cause of much of our creamery butter being weak in body and greasy in texture at normal temperatures.

When it is impossible to reduce the temperature of the cream to a sufficient degree, churn the butter carefully, adding plenty of breaking water, and allow the butter granules to harden in brine made with the coldest water obtainable. By this means it can be handled and worked without serious danger of its becoming greasy.

Soft butter should never be worked. It should be placed in a flat dish covered with a damp muslin cloth, and exposed to a draught, until such time as it is hard enough to be worked and made up.

In summer it is very advisable to churn a thin cream on the farm. Such cream can be more easily churned at a high temperature than a cream testing 40 per cent. or over. Thick cream requires prolonged cooling, so that every particle can be thoroughly chilled, and this, as a rule, without the use of ice, is an impossibility.

In his remarks on texture and body of South African butter on the London market, Mr. Hardy says: "I do not think there is a great deal to complain of in our butters in respect of these points. An inspector from the Ministry of Food informed me that the texture and body were very favourably commented upon, and for that reason it had been popular with merchants for blending purposes."

Colour.—The colour of butter must be of the shade and intensity desired by the market in which it is sold. For local purposes a medium shade is required. A very deep yellow colour is generally looked upon with askance because of a local prejudice against artificial colouring. This is hardly justified, because the same colouring matter, annatto, is almost universally used with general acceptance for colouring milk for cheese-making. It is generally accepted that the natural colour of cream and butter is derived from a pigment called carotin contained in chlorophyll or green colouring matter of plants. This explains why the colour of butter in spring is of a much deeper shade than that of butter made in the winter, when the cows are being fed largely on dry hay or mealie stalks, supplemented with mealie meal, bean meal or other concentrates. In this connection it is remarkable how well-got hay, with the original green colour still retained, maintains the colour of the butter in the winter. Such hay is, of course, of much higher feeding value than the dried grass which is so commonly cut in this country. In addition to good hay, green fodder, such as green barley or forage, should if possible be grown for winter feed.

The breed of cattle also affects colour. It is well known that the Jersey and Guernsey breed give highly coloured cream even in winter, whilst that of the Shorthorn and the Friesland, under similar conditions, is almost white.

Mottled or Streaky Butter.—Mottles and streaks are quite common defects in South African butter. They are caused mainly (1) by the unequal mixing of 'creams of different stages of ripeness, (2) by the unequal distribution of salt throughout the butter, (3) by unequal working of the butter, and (4) by insufficient washing or overchurning whilst the butter is in the granular stage. The remedies are obvious. Different creams should be well mixed and allowed to stand for some time before being churned. The practice of brine-salting should be adopted where possible, and if dry-salting is practised the salt should be of the best quality and finely ground. It should be evenly distributed through a hair sieve over the butter whilst it still is in the granular form, and is better applied in two lots, half at a time, to allow of a more thorough incorporation in the butter. This latter practice is not recommended in very warm weather, as the longer the butter is kept unworked, the softer it becomes.

A further quotation on this point can be made from Mr. Hardy's report: "Mottle or streakiness is due to carelessness during the manufacture of the butter. Probably the commonest cause is insufficient washing whilst the butter is in the granular form, or overchurning before the 'break-water' is added. In the former case, if the washing is discontinued whilst the wash water is still cloudy, a certain amount of casein is conveyed into the butter and clings around the grains; the addition of salt to the butter has the effect of hardening the casein, which forms a tough film round the grains and prevents the salty water or brine from penetrating them. One of the effects salt has on butter is to deepen the colour, consequently the butter which comes in contact with the salt assumes a deeper colour than the inside of the butter grains which do not

so come in contact, and are not salted at all or only lightly salted. The result is 'mottles,' which, however, are not apparent immediately in freshly salted butter, but only show up after a few hours as a rule.

"In the case of butter overchurned before the 'break-water' is added, an uneven grain is almost certain to result, due to the fact that creams at various stages of ripeness and of varying degrees of thickness have been mixed together, and where such cream is churned it will break irregularly; but the addition of water at the first signs of the cream breaking, as shown by a slight clearing of the glass, will reduce the cream to a common degree of acidity and thickness, and the butter will 'come' simultaneously, and an even sized grain be obtained. After the addition of 'break-water,' which should be at a temperature of not more than two degrees lower than that at which the cream was churned, churning should be continued until the grains of the butter are about the size of clover seed, then the butter milk is run off.

"An even sized grain is most important, as when some of the grains are much larger than others, the former are bound to enclose butter milk which no amount of washing will get rid of, with the result that certain portions of the butter will be more affected by the salt than the others, and mottle will appear in the finished article.

"Another common cause of mottles, or probably its more aggravated form known as 'streakiness,' is mistakes in the salting of the butter. If the butter is slightly worked before the salt is added, or if part only of the salt it is intended to use is added before working, and the butter is then partially worked before the remainder is added, streakiness is sure to result, unless the butter is held over in the air lock for several hours and then again worked. The proper way is to add all the salt before the grains of butter have been pressed together by working, or it will not be possible for the salt to become evenly distributed and properly incorporated with one working."

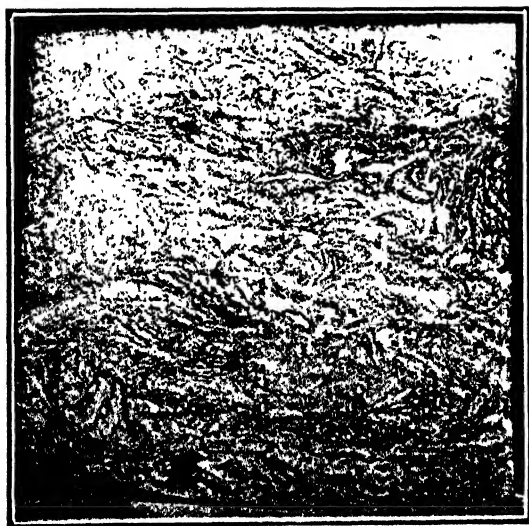
Artificial Butter Colouring.—As already indicated, the use of artificial butter colouring (annatto) is perfectly legitimate if the proper preparation is obtained. The butter maker should not be tempted to use cheese colour for butter making, or *vice versa*, as these preparations are only to be used for the particular purpose for which they are designed.

The amount of artificial colour that must be added varies greatly under diverse conditions, and it ranges from one drop to one pound of butter to an average of five drops to every pound of butter fat in the churn. These figures can only be regarded as approximations, but every standard make of butter colour gives full directions for use on the bottle. As already mentioned, the colour demanded in this country is of a medium shade, and due care should be taken in the use of the artificial colouring to achieve this desired colour.

Salting.—The amount of salt required varies according to the demands of the trade. Usually, if brine salting is adopted, the holding of the butter whilst in the granular stage for half-an-hour in a brine



Defective packing of butter.
From "British and Colonial Dairying" (Thomson).



A remarkably fine photograph showing streakiness in
a 56 lb. block of butter.
From "British and Colonial Dairying" (Thomson).

of one pound of salt to one gallon of water will give the required degree of saltiness. If not, a small portion of salt can be added through a dry sieve whilst the butter is in the granular stage on the worker. If dry salting is practised, the correct proportion varies from half-ounce to one ounce of salt per pound of butter. The salt should be distributed over the butter whilst the latter is in the granular stage, or it can be with advantage applied in two equal portions at an interval varying from two to three hours. If either of these practices is adopted and the salt is finely ground and well distributed, very few, if any, streaks or mottles should develop. For export purposes only the very finest imported salt should be used.

When salting down butter for the winter, see that the salt is thoroughly well ground before being incorporated in the butter. Many samples of salt butter contain so much undissolved and unincorporated salt that on tasting it small pieces of salt grate upon the teeth. This is a fault which is always severely penalised. The remedy is obvious. Only the best brands of imported salt should be used, and these should be in a fine state of division before being used.

Appearance.—Farm butter should be made up in pounds which are uniform and neat in appearance. The paper should be of the best quality. Nothing detracts so much from the appearance and finish as a heavy dark-looking paper. In Mr. Hardy's report he makes the following remarks regarding the appearance of export butter: "An attractive and neat appearance has a considerable influence on the sale and price realised. Buyers often even refuse to examine sample cases from consignments the general appearance of which does not appeal to them. I cannot too strongly impress upon creamery managers that an attractive appearance is just as necessary in the case of second and third-grade butters as with first grade.

"The following are the principal points to attend to in packing butter for export:—

"(1) *Boxes.*—Only new boxes of sufficient strength to stand the voyage and rough handling should be used.

"(2) *Paper.*—Only the very best vegetable parchment should be used for lining the boxes, and care should be taken to see that the corners of the box are lined. An extra piece of parchment paper should be neatly folded to the size of the box and placed on top of the butter. The ends of the lining paper should be neatly folded down on the top in the form of an envelope flap. A double sheet of parchment paper is advocated for lining boxes for export butter, but on no account should brown paper or other than parchment paper be used, even for the outer lining.

"(3) *Packing.*—The butter should be well stamped into the box, the corners receiving particular attention, and no holes or crevices between the lumps of butter should be allowed to remain. The top of the butter which will be revealed to the buyer when the case is opened up should be neatly finished off.

"(4) *Weight.*—The weight of the butter should also be carefully checked; it is advisable to pack at least 56½ lbs. at the creamery, as

only boxes containing 56½ lbs. will be passed by the grader at the coast. Buyers soon fight shy of a brand found to be short in weight.

“(5) *Marking*.—Every case should have all marks neatly stencilled on them. Marking by means of a crayon, as I have occasionally seen, is unsightly and often illegible. The nailing up of the boxes should be carefully performed.”

SUMMARY.

To Avoid Defects In Butter.

(1) Build a cool sanitary dairy. Keep it clean, and whitewash the walls frequently.

(2) Use suitable vessels for storing cream. Do not use petrol or paraffin tins for this purpose.

(3) Provide succulent feed and green stuff for the cows, especially in the winter.

(4) Keep the cream as cool as possible in summer and at a temperature of 60 degrees in winter. Very low temperatures cause cream to develop a bitter flavour.

(5) Churn at least every three days in summer and every four days in winter.

(6) Do not overchurn the butter.

(7) Wash it twice whilst in the granular stage with the coldest water obtainable.

(8) Do not store the butter in a damp, dark place.

(9) Do not work the butter whilst soft. Spread out the grains on a plate, cover it with a damp muslin cloth and expose it to a draught.

(10) Be careful not to overwork the butter. This spoils the texture and makes it greasy.

(11) Use brine for salting. The brine hardens the grains of butter and renders it easier to obtain a good texture.

(12) If dry salt is used, it should be of the best quality, well ground and evenly distributed.

(13) Make up the butter neatly. Use only the best vegetable parchment for wrapping.

(14) Send butter to market in a properly constructed box. Much loss is occasioned in warm weather by the use of boxes without divisions for each pound. A flat-shaped box containing two layers of butter is to be preferred to a deep shape containing five or six layers.

The Sweet Potato.

(*IPOMAEA BATATAS.*)

By J. A. T. WALTERS, B.A., Agriculturist.

The sweet potato grows to perfection in Rhodesia. Our soils and our seasons both conduce to ideal crops. In no part of the country is the season too short or the rainfall too scanty to produce yields that may be considered satisfactory and payable, whilst under favourable conditions returns have been obtained that compare well with those recorded for any other country in the world. Despite the fact that it is grown almost universally by the natives, the white population has up to now been very slow to benefit by their example, although but few fail to appreciate the fine flavour of the sweet potato when prepared as a table vegetable. In most tropical countries this tuber is one of the principal articles of diet, and a certain American report on the subject states that "as a food for the great mass of the people in the warmer parts of our country the use of this crop is exceeded by maize and rice only." But not as a source of human food alone is this root to be commended. Its great value as a stock food, particularly where dairying or pig raising is practised, has long been recognised by those who have used it. Although the plant seems to be indigenous mainly to the tropics and is extremely sensitive to frost, it can be grown outside the tropics in most areas which have a frost-free season sufficiently long to bring the tuber to maturity.

From the practical point of view the sweet potato is almost the only root crop that can be grown for stock feed in any part of this country with what amounts to a constant certainty of success. Even the ordinary Irish potato cannot be relied upon to the same extent, while other roots such as mangel, sugar beet, turnips and field radish, although occasionally giving good yields, are on the whole unreliable, more particularly so in districts and seasons of scanty rainfall. The sweet potato has, further, the additional advantage of combining an edible tuber of high feeding value with vines and leaves that provide heavy yields of succulent and palatable fodder of the utmost utility in the feeding of all stock. That sweet potatoes are good drought resisters is shown by the fact that during the past season at the Salisbury experiment station, with only 16½ inches of rain, yields of tubers were obtained ranging from two tons to six tons per acre, according to variety, and yields of top growth ranging from two tons to eight tons per acre. The following table shows the comparative yields per acre in a favourable and an unfavourable season:—

Variety.	1920-21.		1921-22.	
	Rainfall: 33.4 ins.		Rainfall: 16.7 ins.	
Calabash leaf: Tubers	14,443	lbs.	10,800	lbs.
Vines (green)	20,700	„	16,080	„ *
Common pink: Tubers	25,036	„	12,900	„
Vines (green)	11,600	„	5,640	„

Botanical.—The sweet potato belongs to the convolvulus family of plants, and is known botanically as *Ipomaea batatas*. A near relative is the Morning Glory (*Ipomaea purpurea*), so frequently grown in gardens for its beautiful blue flowers. The sweet potato, however, rarely flowers in this country, although it does so freely in more tropical regions. The flowers resemble those of the Morning Glory, but are smaller in size and purplish in colour; these ripen into a four-seeded pod. The term "sweet potato" is sometimes applied to the yam (*Dioscorea batatas*), which has an edible root and twining foliage. But the vine and foliage of the yam, which may grow as much as 100 ft. in length in a single season, are not eaten by stock, and hence the plant is at a great disadvantage agriculturally when compared with the true sweet potato. The yam, moreover, requires more tropical conditions than the sweet potato.

In a crop of such importance several varieties have been evolved and isolated. The distinguishing characteristics of these varieties are not very obvious, and no definite universally recognised varieties seem to have been separated. In South Africa most of the names are either local or purely descriptive of the character of the tuber or leaf. The need for distinctive names is urgent, as the prospect of extending the propagation of the more desirable varieties depends upon their being clearly described and classified. Steps in this direction have been taken at the agricultural experiment station during the last four years, and up to the present time seven distinct varieties have been separated from those under trial, differing considerably in earliness of maturity, amount of vine and foliage, resistance to drought, yield of tubers, suitability for table or other purposes, etc.

The following key will enable the varieties at present grown in Rhodesia to be distinguished:—

(a) *Varieties with entire leaves.*—

- (1) Tubers red and long, flesh white, early in maturity, stem hairy—**EARLY RED.**
- (2) Tubers brown or yellowish, flesh white, medium late in maturity, very prolific in stem and leaf growth, and highly resistant to drought—**CALABASH.**

(b) *Varieties with 3-lobed leaves (ivy leaf).*—

- (3) Tubers yellow, flesh yellow, stem slightly hairy, early in maturity, more susceptible to drought than any other variety—**EARLY BUTTER.**

* This cutting was taken on 20th March, 1922. A subsequent cutting on 12th June gave an additional 6,000 lbs. of vines.

- (4) Tubers pink, flesh white, stem quite free of hairs, medium early in maturity—COMMON PINK.
- (c) *Leaves deeply cut into 5 or more lobes.*—
- (5) Tubers red and roundish, flesh white, stem very hairy, highly resistant to drought—RED NANSEMOND.
- (6) Tubers white, flesh white, stems very hairy, lobes of leaves long and narrow—COMMON WHITE.
- (7) Tubers white, flesh white, stems slightly hairy, lobes of leaves broad, highly drought resistant—NATIVE.

From the above description it will be seen that a considerable range exists in the several varieties, and while some, such as Calabash and Common Pink, are eminently suited for stock feed on account of their wealth of foliage and weight of tubers, others again are better suited for table purposes. These are Early Butter, Red Nansemond, Common White and Native. Since propagation in the absence of seeds is entirely from the vegetative parts of the plant, the separate varieties can be kept entirely distinct and pure.

Two species distinct from *Ipomaea batatas* deserve mention here: the New Zealand sweet potato (*Ipomaea chrysorrhiza*) and the Chinese sweet potato (*Ipomaea mammosa*). The first of these has been successfully grown at the National Botanic Gardens, Kirstenbosch, producing tubers up to 9½ lbs. in weight. The second is very largely grown in China and parts of the United States, and is preferred by the Chinese to any other kind.

Propagation.—The sweet potato can be propagated from cuttings, tubers, or from rooted slips. In this country it has been customary to grow crops from the cuttings which volunteer early in the season from the remains of the previous year's crop left in the ground. Owing to the readiness with which these cuttings root and their resistance to drought, this method has given very satisfactory results. It is the method advocated for Rhodesia on account of its simplicity and effectiveness. The usual distance of planting is rows 36-40 ins. apart, plants 15-18 ins. distant in the row. Planted in rows 40 ins. apart with 18 ins. between the plants, about 9,000 cuttings are required to set an acre, or, roughly speaking, about ten bags of cuttings. When tubers are employed for propagation they may be planted out in the same way as the ordinary potato. In this case planting should be undertaken as early in spring as possible if a good crop of tubers is to be expected the same season. As each tuber, however, may produce from thirty to fifty slips, it is more economical to grow the tubers early in a prepared bed, where they are placed close together, but not touching. They are then covered with 2 to 3 ins. of sand or light soil, and kept watered. As the shoots from these tubers appear above ground, they are taken and planted in their permanent places in the field. By this means vigorous shoots may be obtained as early as desired, which is of great advantage when a garden crop is required. This method is also useful when a start is being made from a few tubers, such as with a new variety. For field purposes it is estimated that 100 lbs. of

tubers will produce enough shoots to plant one acre at the spacing quoted above.

An experiment conducted on the Salisbury experiment station to test the comparative value of planting from tubers and from cuttings gave the results shown below. The variety known as Early Butter (or ivy leaf) was employed, and the tubers were planted on the 4th October, 1921, the cuttings being planted on the 30th November, 1921. The figures given here are an average of returns from four different cultural treatments:—

	Grown from tubers.	Grown from cuttings.
Weight of tubers, harvested 12/6/22 ...	11,360 lbs.	9,300 lbs.
Weight of vines, cut 20/3/22	6,600 ,,	6,240 ,,

Planting Out.—From the nature of the propagating material it is obvious that suitable weather should be selected for the purpose of planting out. At the same time it is well to remember that these cuttings are extremely hardy and stand considerable subsequent drought if rain falls soon after planting, or if the soil is moist enough to be pressed firmly round the cutting when set out. This operation can, therefore, be performed early in the season, and it is distinctly advantageous not to delay planting beyond mid-December. Two methods of planting are in vogue—on the flat and on the ridge. Ridging has certain advantages, in that it certainly renders the harvesting of the tubers easier. In seasons of heavy rainfall it affords better drainage, which is essential for a healthy crop, but in years of prolonged drought, such as the one just experienced, ridging may have a lowering effect upon the yield. The cuttings should be about 12 ins. long and should be laid horizontally in furrows about 3 to 4 ins. deep, with a few inches of the stem protruding above the surface. Trials conducted with five varieties at the experiment station in 1921-22, to test the effect on yield of ridging as compared with planting on the flat, gave the following results for weight of tubers harvested:—

Variety.	Ridged.	Flat.
1. Red Nansemond	7,620 lbs.	8,280 lbs.
2. Ivy leaf or Early Butter	9,540 ,,	10,480 ,,
3. Common White	6,540 ,,	6,960 ,,
4. Common Pink	11,880 ,,	12,440 ,,
5. Calabash	8,940 ,,	9,280 ,,

The greater ease of lifting ridged tubers will, however, usually turn the scale in favour of planting on the ridge.

Preparation of the Soil and Cultivation.—The essential for this, as for most root crops, is a well-prepared friable soil, rich in organic matter and of sufficient depth to enable the tubers to expand freely. Heavy clayey soils are therefore to be avoided, and the best soil for the purpose is a sandy loam. On poor soils the application of farmyard manure is very desirable either to the crop itself or to the previous crop. The direct application is, however, inclined to give rise to coarse, ill-shaped roots. On the lighter soils sweet potatoes

very profitably follow a leguminous or other green-manuring crop, such as velvet beans. On account of the heavy amount of potash removed in the vines and tubers, Dr. Juritz recommends the application of potassic fertilisers, but on the Gwebi experiment farm, where maize has been grown in rotation with sweet potatoes for several years, the latter crop has been found far less exhausting than many others.

The land should be ploughed as early as possible and as deep as the sub-soil will permit. It should be allowed to stand through the winter and be cross-ploughed with the first rains, or disc-harrowed if the soil is sufficiently friable to render a second ploughing unnecessary. In America, where small tubers are required for table purposes, the second ploughing is invariably shallow, but for large-sized tubers for cattle feed this precaution is unnecessary. After-cultivation should begin early with the object of keeping down weeds and conserving moisture. By spacing the rows 36 to 40 ins. apart, the implements used for maize may be employed in the earlier stages of cultivation. As the vines cover the ground, hand cultivation must be resorted to, and as they root at the joints they should be disturbed as little as possible.

Yields.—Over the whole of Rhodesia, where 712 acres were grown in 1920-21, the average yield was returned as 18 bags of 153 lbs. weight per acre. Statistics for the Union of South Africa give the average yield as 22 bags, the best district being Oudtshoorn, where 430 acres gave an average of 51 bags, and the best individual yield 100 bags per acre on a farm not far from Mossel Bay. At the agricultural experiment station, Salisbury, still higher yields have been obtained on a small scale, as will be seen from the figures published elsewhere in this article. The average yield over the whole of the United States of America in 1919 was 36 bags per acre.

The great disparity in the average yields over the whole country and those obtained in individual cases shows that this crop does not generally receive the attention from farmers that it requires. Common observation leads to the conclusion that the two factors militating against high yields in Rhodesia are insufficient humus or vegetable matter in the soil for the requirements of the crop and too shallow ploughing in the preparation of the ground. Early planting is also desirable, in order that the crop may have the benefit of the whole of the summer season. This is strikingly shown in the following table, which gives the returns obtained at the agricultural experiment station by planting at different dates in 1920-21:—

	Date of planting.	Weight of green tops per acre.	Weight of tubers per acre.
1. Calabash leaf	23.12.20	20,700 lbs.	14,443 lbs.
2. Ivy leaf (Common Pink)	23.12.20	11,600 „	25,036 „
3. Calabash leaf	12.1.21	10,600 „	8,416 „
4. Ivy leaf (Common Pink)	12.1.21	3,260 „	13,272 „
5. Calabash leaf	10.2.21	7,528 „	Failed to mature.
6. Ivy leaf (Common Pink)	10.2.21	7,660 „	Failed to mature.

Variety Trials.—From what has been said earlier in this article, it is obvious that certain of the varieties are especially adapted for stock feeding, while others again excel for table purposes. For use as a vegetable the tubers should be small and well shaped. For cattle purposes, on the contrary, bulk is an important consideration, together with a heavy yield of vine. The variety trials conducted at the agricultural experiment station in 1921-22, which proved to be a season of exceptionally scanty rainfall, gave the following results per acre:—

A. Grown from cuttings planted out 4th October, 1921:

	Tubers.	Vines (green tops).
1. Red Nansemond	7,710 lbs.	4,470 lbs.
2. Early Butter (ivy leaf)	7,830 „	7,920 „
3. Common White	6,030 „	6,090 „
4. Early Red	9,780 „	6,330 „

B. Grown from tubers planted out 30th November, 1921:

5. Early Butter	15,000 lbs.	9,450 lbs.
6. Common Pink	12,900 „	27,000 „
7. Calabash	10,800 „	22,080 „

The tubers referred to above were uniformly harvested on the 12th June, 1922, before the first frost had been experienced. The vines were cut twice, firstly on the 20th March, and the subsequent growth cut again on the 12th June, 1922.

It is obvious, from the yields quoted above, that certain varieties are eminently suitable for stock feed. These are generally late-maturing varieties, requiring a full season to produce their heavy yields of tubers and vines. On the other hand, Early Red, Early Butter, Common White and Red Nansemond produce early-maturing tubers of a size suitable for table purposes. With regard to drought resistance, which was put to a severe test during this last season, the Calabash and Native varieties showed great superiority over the earlier varieties.

Feeding Value.—Analyses of the sweet potato show that, in common with most other root crops, it combines succulence with a richness in carbohydrates and a comparative poverty in protein. The following table, however (an average of 38 analyses with different varieties), indicates that weight for weight they are superior to both the Irish potato and to the ordinary farm root crops in the total percentage of essential food elements, and contain 20 per cent. more dry matter than mangels, turnips, swedes, etc.:—

	Sweet Potato.		Irish potato.	Mangel
	Tubers.	Fresh vines.		
Water	70.0 per cent.	83.0 per cent.	78.9	90.9
Ash	1.2 „	1.5 „	1.0	1.1
Fibre	2.4 „	3.1 „	0.6	0.9
Protein	2.2 „	2.1 „	2.1	1.4
Carbohydrates				
(starch and sugar)	23.2 „	9.5 „	17.3	5.5
Fat	1.0 „	0.8 „	0.1	0.2

SWEET POTATO VARIETIES.

RED NANCEMOND.

EARLY RED.

COMMON WHITE

BUTTER.

CALABASH

NATIVE

COMMON PINK

5-lobed leaves

Entire leaves

Long leaves



The Calabash sweet potato, showing the heavy growth of vine and foliage,
Agricultural Experiment Station, Salisbury.

SWEET POTATO VARIETIES:

EARLY BUTTER

NATIVE.

RED NANSEMOND



COMMON WHITE. CALA WASH. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.



Dr. Juritz, as a result of analyses in the Union of South Africa, further states that the ash of the sweet potato plant contains 50.3 per cent. of potash. In America three bushels of sweet potatoes are regarded as of equal feeding value with one bushel of maize when both are used with suitable concentrates. At the Florida experiment station dairy cows fed on succulents in the form of sweet potatoes produced in a given period 26.2 gallons more milk than similar cows receiving the same concentrates, but succulents in the form of sorghum silage.

From the month of April onwards until frost occurs the plant is usually fed to stock by utilising the green tops. The tubers may be allowed to remain in the ground until required, and as they are available after the tops are over, the crop provides a continuous supply of succulent food for a very considerable portion of the dry season. The sweet potato is thus of the utmost utility in the feeding of all classes of stock. Pigs may be turned into the field to root the tubers out for themselves, while in the case of large acreages there would seem to be no reason why cattle should not be allowed to graze the tops if judiciously supervised. This food, however, should be supplemented with concentrates rich in protein to provide the balance of ration necessary for special purposes, such as dairying or the production of beef. American feeding trials indicate that the feeding of 100 lbs. of sweet potato tubers is equal to feeding 150 lbs. good maize silage; hence the concentrates usually employed with silage may proportionately be used with sweet potatoes. A recent American publication (*The Sweet Potato*, by Hand and Cockeram) states that "one part of ground nuts ground in the shell to three parts of sweet potatoes will secure a well-balanced ration."

Hay made from the vines is palatable and of good feeding value, but the attempt to make it at the experiment station, Salisbury, was not very successful. In some cases it took several weeks to cure the vines properly, and in every case the colour of the hay was very dark. The loss in weight also was very high, averaging as much as 81 per cent. in the case of six varieties experimented with.

The removal of the vines for feeding early in the season before the tubers are mature affects adversely the ultimate yield of tubers. This is well shown in the following table, which gives the yield over an area where the tops were removed on the 20th March, compared with the yield obtained where the tops were allowed to remain until the tubers were harvested on the 12th June:—

	Vines removed 20.3.22.	Vines removed 12.6.22.
	Weight of tubers per acre.	Weight of tubers per acre.
Red Nansemond	4,140 lbs.	7,710 lbs.
Early Butter (ivy leaf)	8,940 "	15,000 "
Common White	4,020 "	6,030 "
Early Red	10,470 "	9,780 "
Common Pink	12,300 "	12,900 "
Calabash	8,460 "	10,800 "

As an offset against this loss of tubers, it may be stated that the second growth of vine after the March cutting was quite considerable, amounting on an average of four trials to one-fourth the original weight. The weight of vine obtained in March was also considerably higher than that obtained in June, where the vine was allowed a full season's growth, as is shown below. This is due, of course, very largely to the loss of water content in a season of exceptional dryness.

	Weight of vines as at 20.3.22 per acre.	Weight of vines as at 12.6.22.
Red Nansemond	3,510 lbs.	1,950 lbs.
Early Butler	6,240 „	1,560 „
Common White	4,650 „	1,830 „
Early Red	5,370 „	1,620 „
Common Pink	14,700 „	5,640 „
Calabash	16,080 „	6,000 „

From what has been said, it is obvious that we have in the sweet potato a root crop of remarkably heavy cropping power, highly resistant to drought, suitable to most districts of the country and productive of a foodstuff of great value for the needs of both man and beast. Although grown by the natives on a limited scale, the extended use of this crop would appreciably minimise the danger of famine in years of scanty rainfall such as the present. As a commercial crop it is full of possibilities for the production of industrial starch and alcohol, and these aspects of its utility are to-day being actively enquired into. Figures already at our disposal show that as a source of starch it stands in the front rank of raw materials. An article in the *South African Journal of Industries* on its possibilities for alcohol states that "with a yield of two tons of tubers per acre the theoretical amount of alcohol obtainable from an acre of sweet potatoes would be 70 gallons, or about 60 gallons in actual practice." Finally, the results obtained at the experiment stations and elsewhere in Rhodesia indicate that we have here a climate second to none for its successful and profitable propagation.

Rhodes Inyanga Estate.

CATTLE RETURNS, 1917-1921.

By ERIC A. NOBBS, Ph.D., B.Sc.

Introductory.—Shortly after the Government took over the management of the Rhodes Inyanga Estate on the 1st July, 1917, regular monthly cattle returns were commenced. These records have been tabulated with a view to ascertaining the actual results obtained as a guide to the future management of the stock. In addition to the tables attached hereto, the results have in certain cases been prepared in graphic form which visualises them in an instructive and striking manner and adds very much to the interest of these otherwise rather heavy masses of figures. It is not, however, practicable to reproduce these graphs in print.

It is not claimed that the figures are in any way extraordinary, and they are published chiefly to indicate what any stock raiser may learn by careful observation month by month of the numerical fluctuations of his herds. Methods of collection of returns on ranches vary: thus some farmers record the births daily, others do so monthly, others only when cutting and marking the calves, others at weaning only, and so on, each system having its advantages according to whether stock are kraaled or run loose, the degree of intensiveness of management, the numbers concerned and the scale of operations generally.

At Inyanga calving is restricted to four months in the year, and the calves are counted in December, the few which are dropped during the next month or two being added later. The cattle run loose, and this method of counting the increase mainly at one date has been found to be the most practical there, although it is open to the criticism that a certain small number of births and deaths of young calves may occur which are not recorded. By ear-marking the calves shortly after birth and keeping a note of the numbers, the reports of the herd boys are checked, and the error from this cause, if any, is very slight. It is to be recollected that the cattle are not kraaled at night and that Inyanga lies amidst great mountains, on the steep slopes and folds of which cattle may be overlooked, especially during the misty weather which occurs so frequently there.

Since the estate was transferred to the charge of the Government it has been under the local management of Mr. H. C. Michell, who

has been there for upwards of ten years, with the assistance of Messrs. Barnes and Moodie, under the general supervision of the Director of Agriculture.

It is proper to add that the cattle form only a portion of the farming operations, which include also a large flock of sheep, apple orchards, timber plantations and certain crops for farm use, whilst much of the available time and labour is devoted to development of the estate, apart from matters of maintenance.

It is to be recollected throughout these notes that the increase has all been the result of breeding; no purchase of cows or heifers has been made, only of bulls to replace old ones and to meet the needs of the natural increase of female stock.

For purposes of certain calculations, not the number of stock at the beginning or end of a year is taken, but the averages found from twelve monthly counts, divided by twelve, and called for convenience the monthly average number.

The increase from year to year is, however, more fairly represented by the corresponding number recorded for the corresponding date; for example, at each 31st December.

Total Figures.—The total cattle at the commencement of operations on 1st July, 1917, was 1,033 head. At 31st December, 1921, the number was 1,865, a gain of 832 or 80.5 per cent., after sales to the number of 506 and deaths to the number of 345 had taken place—a gross total increase of 1,338 or 129.5 per cent. in four years and six months, or 23.5 per cent. annually.

The number of cattle each month with their classification is shown on Table A. The figure for calves shows only those at the annual count of increase, as already mentioned. Thus it follows that in the beginning of each year there is a noticeable increase, followed by a gradual fall each month dependent upon deaths and sales. On ranches where cows calve all the year through and calves are added to the strength monthly, weekly or daily, the figures are or ought to be constantly increasing ones, and corresponding differences would appear in graphs illustrating the two systems. The common factors of increase, death rate and monthly average would be comparable in whatever way they are reached.

Classification.—The percentage distribution of the different classes of stock at the end of each year is of interest. When the estate is fully stocked, a stationary normal proportion between these classes will be reached or approached, but that equilibrium cannot possibly be established for a long time yet.

**PROPORTION OF CLASSES OF CATTLE TO THE TOTAL
AT 31st DECEMBER IN EACH YEAR.**

	1917.		1918.		1919.		1920.		1921.		Average over 5 years.
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Per cent.
Stud bulls	8	.67	19	1.4	24	1.5	21	1.2	28	1.5	1.2
Cows -	425	35.7	484	36.5	584	36.9	646	38.1	742	39.8	37.4
Heifers -	148	12.4	146	11.0	124	7.8	158	9.3	160	8.5	9.8
Calves -	260	21.8	235	17.7	333	21.0	312	18.4	386	20.7	19.8
All oxen and young bulls -	347	29.2	440	33.2	516	32.6	558	32.9	549	29.5	31.4
Totals -	1,188		1,324		1,581		1,695		1,865		

These figures are based upon the December returns for each year in Table A.

The oxen, of course, are of various ages, but for these returns are all grouped together, along with a few grade bulls kept to meet a limited local demand, and the trained oxen which do the necessary transport, a relatively large number, as the estate is nearly sixty miles from a railway station. The total numbers have not hitherto been so large as to admit of oxen of every age being run in separate mobs, as would of course be done on any ranch carrying greater numbers, and as will shortly be the case here.

Oxen are generally sold at three-and-a-half to four years old, the trained oxen at a greater age and the bulls as yearlings. The best oxen have been sent to the grain growing districts for fattening, and have done well.

Increases.—The increases of all stock are as follows:—

At 31st Dec.	Numbers.	Increase (net).	Increase per cent.	Sales.
1917	1,188	...	...	...
1918	1,324	136	11.44	88
1919	1,581	257	19.41	48
1920	1,695	114	7.21	147
1921	1,865	170	10.03	146

These figures indicate the actual numbers at the end of each year and the difference for each year after diminution through death and sale. The high figure of net increase in 1919 is accounted for by the relatively small sales that year.

The net increase over four years after deducting sales and deaths—from 1,188 to 1,865—is 677 head or 56.9 per cent.; an average annual net increase of 14.2 per cent. The corresponding figure for the whole of Southern Rhodesia for the same period is 12.9 per cent.

The increase in the breeding stock detailed in Table A presents interesting features. The cows show an increase annually as the heifers are transferred to them, with a corresponding drop in the latter. Thereafter there is a gradual fall owing to deaths and culling. The breeding season has been gradually made earlier with a view to improving the calf crop. Thus in 1917 the heifers were transferred in November, in 1918 in December, but in 1919 in September, and in August in 1920 and 1921.

INCREASE IN NUMBER OF COWS.

Year.	Number of cows.	Heifers transferred to cows during year.	Cows sold during year.	Cows died during year.	Net increase.	Annual percentage increase.
1st July, 1917 ...	378	...	...	...	...	...
31st December, 1917	425	56	...	...	47	...
31st December, 1918	484	121	47	15	59	13.88
31st December, 1919	584	131	27	16	100	20.66
31st December, 1920	646	124	14	48	62	10.61
31st December, 1921	742	140	15	27	96	14.86

These figures show that over four complete years the net increase of cows by the addition only of heifers, and after allowing for reductions by sales and deaths, is 317 head, that is from 425 to 742, or 74.5 per cent., equivalent to an average annual increase of cows of 18.6 per cent. by breeding alone without any additions by purchase.

Transfers.—The number of calves born in one year transferred in the next year to oxen and to heifers and from heifers to cows in the following year naturally bears a relationship, and the increases in these classes in coming years can be foreseen and provided for accordingly.

TRANSFERS.

Year. 31st December.	Calves, both sexes.	Calves transferred		Heifers transferred to cows.
		To oxen.	To heifers.	
1917	260	36	30	56
1918	286	166	137	121
1919	355	115	133	131
1920	347	181	169	124
1921	380	143	159	140

Calving.—The natural increase recorded each year of calves reared (rather less than that for calves born) works out for the four years at 65.5 per cent., or about two calves per cow in three years, the highest being 73.2 and the lowest 59.4, as shown below.

RETURN OF CALVES REARED.

Year.	Number of cows (breeding cows, not heifers) at 1st January.	Number of calves reared during year.	Percentage of calves to cows.
1918	425	286	67.3
1919	484	355	73.3
1920	584	347	59.4
1921	646	402	62.2

The diminished calving in 1920, as soon as it became apparent, led to the introduction of measures which it is hoped will give improved returns in the future, and consisted mainly in the treatment of and the number of the bulls used.

Sales.—Sales are an arbitrary matter, depending on considerations as to prices and the need of realising, as well as the condition of the oxen and the proportion of aged cows and culls sold "to save their lives." Sales may have to be accelerated to realise money or may be retarded in the face of unfavourable markets or in the hope of improvement.

The sales over the whole period available were as stated, 506, an annual average of 7.59 per cent. on the monthly average basis. This is

not to be confused with a financial dividend, though it bears an important relationship to it, and the higher the aggregate sales without diminution or deterioration of the breeding stock the better. At Inyanga the number of cattle being still small as compared to the total area, only one to about 66 acres, it follows that there is no surplus breeding stock for sale, only oxen, bulls and very old cows being disposed of. The actual figures are as shown in Table A, and amount to 88, 48, 147 and 146 head respectively in each of the four years under report, the sales being greater in the first six months than in the latter half of each year.

The average prices of oxen in each year were as follows:—

	Average price sold off farm.	Average price of stall-fed oxen.
1917	£8 9 0	
1918	£9 6 0	
1919	£11 12 6	£17 10 0
1920	£12 13 0	£22 5 0
1921	£8 0 0	£13 7 6

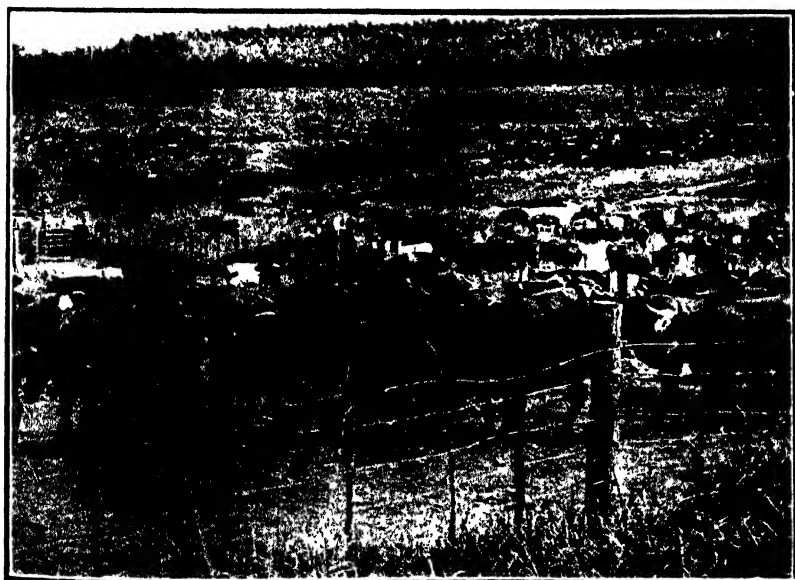
Owing to the remote and elevated situation of the estate and the class of the cattle, it has been found desirable to send the best of the mature oxen to be stall fattened on grain silage and hay at the Government Experiment Farm, Gwebi, whereby they are brought into prime condition, and at the same time the foodstuffs grown on that farm are converted into readily saleable form and a system of rotation and manure production developed ensuring maintenance of soil fertility. In addition, a series of experiments have been conducted over several years which have laid down the lines on which stall feeding of cattle in Southern Rhodesia can usefully be conducted, a practice which shows signs of rapid adoption and extension. Oxen are also sold in trained spans and in fair grass fed condition for slaughter during the months of January to April.

Mortality.—The death rate is an item which deserves the closest examination, as it is here by attention and management that much difference can be secured in results. A life saved of an adult or partly grown animal is of more importance than a calf born. The annual mortality on the average number of cattle during the year has been successively 6.19, 4.52, 5.87 and 3.89 per cent., and in the last year a further 2.18 per cent. on account of quarter-evil. Apart from this visitation, the average annual death rate for stock has been 5.11 per cent., or including it, 5.66 per cent. for the four years. The figures are satisfactory and show a tendency to diminish, but taken month by month they fluctuate considerably, and no marked seasonal effect is observable, though the period January to May has lower figures than the rest of the year, and March and April are generally the healthiest months. The mortality is highest from July to November.

Causes of Death.—Desirable as it always must be to see a high birth-rate, the most crucial return on a cattle ranch is that for the losses and the causes of death. The losses in each year for yearlings and adult stock are given to show the spasmodic character of most of



Mob of cattle at Rhodes Inyanga Estate.



Dipping day at Rhodes Inyanga Estate.

these occurrences. They are in practice recorded each month, and over a period of four years and three months show little if any seasonal regularity, but are spasmodic and erratic, rendering preventive steps difficult. Quarter-evil has been the principal single factor, claiming 47 victims in one month before inoculation exercised its effects. Next to this, deaths apparently from redwater and gall-sickness are the most common of those due to specific diseases.

Deaths of a violent nature amount to practically one half the total. These include snake bite, veld poisoning, injuries, poverty, drowning, weaklings and carnivora, chiefly leopards, though lions have also taken a toll. Carnivora are the chief cause of loss other than disease, as is not surprising in a mountainous region with very few neighbours on north, south and west and none to the east at all

SUMMARY.

The number of cattle on the Rhodes Inyanga Estate has risen from 1,033 on 1st July, 1917, to 1,865 on 1st January, 1922, that is, by 832 head or 17.9 per cent. per annum.

With this should be taken into consideration sales during that period of 506 head, equivalent to 10.8 per cent. per annum.

The number of breeding cows has risen from 378 to 740 head. Births have been at the average rate of 65.5 per cent. of the cows; in the worst season 59.4 per cent., in the best season 73.3 per cent.

Mortality of all classes has averaged 5.6 per cent. per annum. Mortality of calves under one year averages 7.24 per cent., and for all stock above that age 5.5 per cent.

The classification at 1st January, 1922, was 1.5 per cent. stud bulls; 39.8 per cent. cows; 8.5 per cent. heifers; 20.7 per cent. calves, and 29.5 per cent. for all oxen and young bulls.

TABLE A.—MONTHLY CATTLE RETURNS.

Date.	Stud bulls.	Calves.	Heifers.	Cows.	All oxen and young bulls for sale.	Total cattle.	Deaths during month.	Mortality per cent.	Sales.
1917									
30th June ...	11	79	175	378	390	1,033	...	...	...
30th September	9	69	180	375	385	1,018	15	.484	3
31st October ...	9	69	180	375	385	1,018	6 } 12	.589	...
30th November	8	...	149	427	349	933		.589	73
31st December	8	260	148	425	347	1,188	4	.428	1
1918									
31st January ...	8	290	148	423	347	1,216	7	.589	...
28th February	8	307	147	421	347	1,230	3	.246	...
31st March ...	8	307	146	421	346	1,228	2	.162	...
30th April ...	8	307	145	419	346	1,225	3	.244	...
31st May ...	5	307	144	418	307	1,181	3	.244	41
30th June ...	5	42	269	385	443	1,144	6	.508	31
31st July ...	5	19	273	384	451	1,132	12	1.048	...
31st August ...	5	19	266	384	452	1,126	6	.529	...
30th September	5	1	266	367	455	1,094	11	.976	16
31st October ...	5	1	265	366	452	1,089	5	.457	...
30th November	12	1	265	366	445	1,089	7	.643	...
31st December	19	235	146	484	440	1,324	7	.643	...
1919									
31st January ...	20	258	133	491	439	1,341	7	.528	...
28th February	22	260	133	491	436	1,342	6	.447	...
31st March ...	22	260	133	489	436	1,340	4	.298	...
30th April ...	21	258	133	488	414	1,314	7	.522	19
31st May ...	19	41	248	482	520	1,310	2	.152	6
30th June ...	19	41	246	476	519	1,301	3	.229	6
31st July ...	19	28	247	475	522	1,291	10	.763	...
31st August ...	19	26	246	475	520	1,286	5	.387	...
30th September	18	26	114	605	518	1,281	5	.388	...

Date.	Stud bulls.	Calves.	Heifers.	Cows.	All oxen and young bulls for sale.	Total cattle.	Deaths during month.	Mortality per cent.	Sales.
1919									
31st October ...	18	12	124	605	519	1,278	3	.234	...
30th November	18	12	124	588	516	1,258	3	.234	17
31st December	24	333	124	584	516	1,581	4	.318	...
1920									
31st January ...	24	324	124	572	516	1,560	2	.126	24
28th February	22	344	124	569	491	1,550	6	.384	28
31st March ..	22	342	125	568	491	1,548	2	.120	...
30th April ...	22	342	125	568	490	1,547	1	.064	...
31st May ...	22	341	125	566	432	1,486	4	.251	57
30th June ...	22	353	125	561	430	1,491	7	.471	...
31st July ...	22	352	124	557	430	1,485	8	.536	...
31st August ...	22	38	161	672	561	1,454	10	.673	21
30th September	22	16	157	664	577	1,436	18	1.237	...
31st October ...	21	16	154	662	573	1,426	7	.487	3
30th November	21	6	158	650	573	1,408	18	1.262	...
31st December	21	312	158	646	558	1,695	5	.355	14
1921									
31st January ...	21	332	158	629	502	1,642	4	.236	69
28th February	21	331	158	627	500	1,637	5	.304	...
31st March ...	21	330	158	625	499	1,633	4	.244	...
30th April ...	20	322	143	624	485	1,594	39	2.385	...
31st May ...	20	318	143	624	485	1,590	4	.250	...
30th June ...	17	10	302	621	570	1,520	8	.503	64
31st July ...	17	10	302	619	555	1,503	3	.197	12
31st August ...	17	10	162	755	554	1,498	4	.267	1
30th September	17	10	160	747	554	1,488	10	.66	...
31st October ...	28	10	158	744	550	1,490	9	.67	...
30th November	28	10	158	742	549	1,487	3	.20	...
31st December	28	386	160	742	549	1,865	2	.13	...

CAUSES OF DEATHS, 1918-1921.

	Year 1918.				Year 1919.				Year 1920.				Year 1921.				4 years, 1/1/1918 to 31/12/1921.		
	Adults	Unbranded calves.	All ages.	Mortality per cent.	Adults.	Unbranded calves.	All ages.	Mortality per cent.	Adults.	Unbranded calves.	All ages.	Mortality per cent.	Adults.	Unbranded calves.	All ages.	Mortality per cent.	Adults.	Unbranded calves.	All ages.
Redwater	...	3	...	...	10	...	...	...	3	16	3	.02	...	9	...	...	3	...	3
Gall	...	5	3	.25	3	...	10	.76	...	3	16	1.06	...	4	...	...	38	...	38
Stomach	5	.43	...	...	3	.22	...	...	...	...	...	...	...	...	15	...	15
Lungs	...	1	1	.08	...	...	...	...	1	...	1	.06	...	...	...	...	1	...	1
Tumours	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Snake bite	...	1	1	.08	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Unknown disease	...	4	6	.51	1	...	1	.07	...	1	6	.40	...	1	...	.06	...	...	...
Calving	2	...	2	.15	...	5	5	.33	...	1	...	.33	...	...	...
Rejected by dam
Weaklings	...	7	8	.68	10	2	12	.91	...	15	1	1.06	...	2	...	.13	...	...	...
Drowned or bogged	...	9	9	.77	6	...	6	.45	...	8	16	1.06	...	2	...	.12	...	...	...
Injuries	...	5	8	.68	9	...	9	.69	...	6	3	.53	...	6	...	.15	...	...	...
Poison (veld)	...	12	12	1.03	1	...	1	.07	...	1	7	.46	...	6	...	.37	...	...	...
Carnivora	...	9	14	1.20	7	7	14	1.07	...	3	5	.06	...	3	...	.25	...	...	...
Poverty and old age	...	4	4	.34	1	...	1	.07	...	14	14	.93	...	6	...	.37	...	...	...
Quarter evil	31	16	.3	...	...	...
Totals	59	13	72	...	50	9	59	...	81	7	88	...	78	17	95	...	268	46	314
Average number of cattle	1007	155	1162	...	1184	121	1305	...	1264	234	1498	...	1398	167	1565	...	...	...	...
Per cent.	5.86	8.38	6.19	...	4.22	7.43	4.52	...	6.4	2.99	5.87	...	5.58	10.18	6.07	...	...	...	...
Excluding quarter evil																	3.36	.6	3.89

SOUTHERN RHODESIA.

Report of the Chief Veterinary Surgeon

FOR THE YEAR 1921.

AFRICAN COAST FEVER.—A schedule is attached showing the centres at which infection existed and the mortality. One fresh outbreak occurred, and the total mortality was 204, as compared with three fresh outbreaks and a mortality of 765 head during the previous year. It will be seen from this schedule that no case of Coast Fever occurred anywhere in the Territory from 1st June until the end of the year. Although the position is more satisfactory than at any time since the introduction of the disease in 1901, I am not sanguine enough to say that the complete eradication of all infection is within sight. Time after time recrudescences have occurred long after areas had been released from quarantine, and fresh outbreaks have unexpectedly and inexplicably occurred in districts not previously affected. It is necessary, therefore, that there should be no relaxation of the present restrictions and procedure; the greatest vigilance should be exercised by stock owners and the officials of this Department in reporting and investigating all cases of sickness and mortality amongst cattle where the cause is not clear. The dipping of cattle as required by the regulations and the early detection of infection will assuredly result in reducing losses to a minimum, and in preventing the widespread dissemination of infection in the unfortunate event of the disease existing at any centre at present unknown and unsuspected.

Melsetter.—At the beginning of the year there were six centres of infection, of which four were released from quarantine. At the Tilbury Estate a heavy mortality occurred during April and May, but ceased after the removal of the infected herds to clean veld through temperature camps. At Quagga's Hoek two animals were destroyed in March, since when there has been no case of sickness.

Gwelo.—No further infection occurred on the farms Clearwater and Northfield, and all restrictions were removed in October.

Mazoe.—No case of disease occurred at the three infected centres except a calf at Sleamish during the month of February. The guard area was considerably reduced in June.

Matobo.—A fresh outbreak occurred on the farm Vimbi in February. Two oxen strayed from the farm in December, 1920, and were

impounded at Plumtree. A permit was issued for their return to Vimbi, but instead of being taken by the route laid down, they were driven through the infected area, with the result that both died from Coast Fever about four weeks afterwards. The Vimbi cattle were being dipped at a tank on an adjoining farm, with various other herds totalling well over 1,000 head, and pending the erection of the necessary tanks and the fencing of the farm Vimbi this procedure was continued, the dipping interval being reduced to three days. There was no further case of disease amongst any of the cattle directly or indirectly involved. At the previously infected areas the mortality ceased at the end of April.

CATTLE CLEANSING ORDINANCE.—The district of Inyanga, excluding a strip along the eastern border where there are very few cattle, was brought under the operation of this Ordinance, and dipping is now being satisfactorily carried out.

During the year 240 dipping tanks were erected, bringing the total number to over 2,000.

The system inaugurated in 1920, whereby Cattle Inspectors were supplied with the isometer testing apparatus, after a course of instruction at the chemical laboratory, is working most satisfactorily, and has proved a great convenience to stock owners, besides saving the expense of forwarding samples to Salisbury and relieving the officers of the chemical department of an enormous amount of routine work.

Complaints have been made that inspections are not frequent enough to ensure that the letter of the law is observed by all stock owners in the areas under the operation of the Ordinance. It is true that some owners are most casual, not only in regard to the regularity of dipping, but in maintaining the dipping solution at or near the prescribed strength; but matters are improving, due partly to a large number of prosecutions for tick-infested cattle, and on the whole it may be said that the provisions of the Ordinance are reasonably observed. Apart from the official inspection returns, the absence of ticks on cattle on the roads and at cattle sales may be taken as an indication of how dipping is being carried out. Another indication is the quantity of dip imported or manufactured in the Territory; it is estimated that sufficient dip was sold during the year to dip 1,500,000 head of cattle fifty times.

INFECTIOUS ABORTION OF CATTLE.—The existence of this disease was demonstrated by the agglutination test in 94 herds, an increase of 58 over the previous year. This, however, does not represent the prevalence of the disease, as it is certain that many owners have not reported its presence in their herds. The virulence of the infection appears to vary considerably; for instance, the District Veterinary Surgeon, Gwelo, states that in some cases only one or two abortions occurred, whilst in others not only was there a large number of abortions, but many of the cows were permanently affected by becoming sterile. In my last annual report I suggested that the low birth rate reported from time to time amongst ranching and other herds was due to the existence of infectious abortion. To gain some definite

information on the point, certain observations were made on a large ranch where abortion had recently been diagnosed amongst the young breeding herds. Six herds of aged breeding cows which had been giving average calf crops, and amongst which the existence of this disease had never been suspected, were tested and the existence of the disease proved in each by the agglutination test. From this, and from our knowledge that immunity is gradually established in a herd, it would appear that the disease has existed for many years past on this particular ranch, and that the low average birth rate is due to its prevalence amongst the young breeding herds, and it is reasonable to suppose that the same process has been going on in many other herds throughout the Territory.

Legislative measures for the control of infectious abortion are not likely to prove successful, chiefly because many infected animals do not abort, but are nevertheless capable of spreading infection, and may remain infective through several successive pregnancies. It is evident, therefore, that every breeding animal in an infected herd is a potential reservoir of infection, and that quarantine, segregation or destruction of patent aborters would not prove satisfactory. In small herds all infected animals could be eliminated by the agglutination test; but even if such animals could be disposed of satisfactorily, the process, as a general measure, is not feasible. It is possible that with the further knowledge that must result from the investigations now being pursued in this and other countries some radical means of dealing with the disease may be evolved; meantime we must rely on vaccination and ordinary prophylactic measures, with the object of reducing the losses and the spread of infection. Supplies of the "devitalised" vaccine prepared by the Director of Veterinary Research are now available.

TUBERCULOSIS.—At the Shangani Estate the herd in which the disease was discovered the previous year was re-tested with tuberculin, and nine re-acting animals were isolated. No cases recorded elsewhere in the Territory.

QUARTER-EVIL.—This disease exists now in every district. The total mortality reported amounted to 3,142 head. Cases occur all the year round, but the heaviest mortality was reported during the winter months. All vaccines have been discarded in favour of aggressin and Leclainche Vallee's liquid preparation, both of which have given most satisfactory results.

ANTHRAX.—Three cases occurred in the Shamva section of the Mazoe district and one in the Mtoko district, the animals affected being cattle. All in-contacts were vaccinated with Pasteur vaccine. The cattle on a number of farms in the Mazoe district, where the infection is known to exist, were also vaccinated.

EPHEMERAL FEVER (Three-days' Sickness of Cattle).—As usual, this disease was prevalent during the summer months, with practically no mortality.

MYIASIS (Screw Worm) OF CATTLE.—This affection was not so prevalent as during the previous year. It is, as a rule, most in evidence

during the summer months, but in certain localities cases occurred during the winter months, generally low-lying areas with plenty of moisture and vegetation.

TETANUS.—Tetanus is so rare amongst the domestic animals in this Territory that the occurrence of a number of cases is worthy of record.

TRYPANOSOMIASIS.—A slight mortality occurred amongst cattle in the Wankie, Melsetter, Hartley and Darwin districts.

HORSE-SICKNESS.—The total mortality was 186 horses and mules, compared with 124 the previous year. The preventive inoculation of horses with the vaccine supplied by the Director of Veterinary Research was largely practised during the year. The subject is fully dealt with in the report of this official.

GLANDERS.—No cases of glanders occurred, and no re-action to the mallein test, which is applied to all horses, mules and donkeys on importation.

EPIZOOTIC LYMPHANGITIS.—No case of this disease occurred during the year.

SWINE FEVER.—One outbreak occurred in the Lomagundi district; 29 animals died and the remainder were destroyed.

IMPORTATION AND EXPORTATION OF STOCK.—A schedule is attached showing the number of animals imported and exported.

AFRICAN COAST FEVER.

INFECTED AREAS AND MORTALITY, 1921.

[illegible]

EXPORTATION OF STOCK.

	Slaughter Cattle.	Breeding Cattle.	Oxen.	Horses.	Mules.	Donkeys.	Pigs.	Sheep and Goats.
Union of South Africa	6,958	3,145	174	6	3	..	495	296
Northern Rhodesia ..	.	21	..	42	2	215	125	698
Belgian Congo .		351	..	16	10	133	624	1,233
Portuguese East Africa	1,066	465	228	26	19	9	210	279

IMPORTATION OF STOCK.

	Bulls.	Heifers.	Sheep and Goats.	Horses.	Mules.	Donkeys.	Pigs.
From the United Kingdom ..	36	22	.	...	...	...	...
From Union of South Africa	592	357	28,533	1,495	397	679	78

Propagation of Kudzu Vine

(*PUERARIA THUNBERGIANA*).

By H. C. ARNOLD, Assistant-in-charge, Agricultural Experiment
Station, Salisbury.

The practical value of the kudzu vine for pasturage, hay or silage has been dealt with in Bulletin No. 388, published in this *Journal* for February, 1921. Since that date further experience with kudzu has fully justified the views therein expressed of the importance of this plant as a Rhodesian fodder crop. As a rank growing perennial legume, kudzu promises to prove of immense value to this country. It appears to thrive well on all soils, and can be confidently recommended for trial in all parts of the Territory.

The propagation of the vine, however, presents some difficulties, and it is the purpose of these notes to describe methods by which stocks of this plant may be increased from either seeds or "cuttings."

Propagation from Seed.—Kudzu seed is expensive, of low germinating power, and growth in the seedling stages is slow. It is not therefore advisable to attempt to establish large acreages by sowing *in situ*, except where special attention can be given as regards the supplying of water when necessary and protection from leaf-eating insects. The germinating power of different samples of kudzu seed varies considerably; in many cases it is very low, and should therefore be tested before being sown. To do this sow a known number of seeds—fifty or one hundred—in a place where they can be observed closely, as between pieces of damp blotting paper. If kept damp and moderately warm, those seeds the vitality of which is unimpaired will sprout within seven to twenty days. In this way the amount of seed required to produce a given number of plants may approximately be ascertained.

If sowing *in situ* is decided upon, the site must be ploughed as deeply as possible, though if preferred, strips only, about six feet wide, can be ploughed until after the seedlings have become established.

Seed-beds one to two feet in diameter should be prepared by pulverising and levelling the soil at intervals of from ten to fifteen feet. Sufficient seed is then sown half to one inch deep to obtain from four to six seedlings on each seed-bed. Under favourable conditions young plants will appear after ten days from date of sowing, and provision should be made before this for their protection from leaf-eating insects.

Sowing may take place as soon as danger from frost has passed, but should not be practised after the end of January, except where water can be supplied by artificial means during the following dry season.

After the first four or five leaves have developed, seedling kudzu can resist three or four weeks of drought successfully, provided there is moisture in the sub-soil; but if weekly waterings can be given, when the rains fail, the resulting vigorous growth will more than compensate for the trouble incurred.

It is thought, however, that in most cases it will be found more convenient to sow the seed in tins first, from August to October, and then to transfer the resulting seedlings to permanent quarters after copious rains have fallen. The method of sowing the seed thickly in large tins or seed-beds, and then transplanting to other tins or to the open ground, though often practised successfully with other plants, has given very unsatisfactory results with kudzu. The reason for this is that, while quite small, the plantlets develop a spreading root system, so that when a number are growing together it is practically impossible to separate them without breaking a number of their roots, and when this is done growth is checked so severely that several months elapse before the plants recover. When half petrol or paraffin tins are used, the seed should be sown thinly so that not more than four to six plants grow in each tin, and when these are two or three inches high they should be transplanted into permanent quarters, care being taken to keep soil and roots intact as far as is possible during the operation.

Small tins give more satisfactory results than large ones, and those three inches or more in diameter are suitable for this purpose. If tins are not available, strips of tin or similar material about four-and-a-half inches wide by a foot long may be made into cylinders and used instead. No bottom is required if the cylinders are packed closely in trays or boxes. Half an inch or so of porous material is placed at the bottom of the trays for drainage, and the tins or cylinders are filled to within an inch of the top with a good compost. Sufficient seed is sown to produce two plants to each receptacle, and is covered with half an inch of soil. The tins are then staged in a shady situation and water supplied as required. Germination is irregular and seedlings may appear at intervals of from ten to forty days after sowing. The young plants may be transplanted to permanent quarters at any time after they have grown four trifoliate leaves, but may be kept in the tins until the vines are a foot long if desired.

During the operation of removing the young plants from the tins, care should be exercised to preserve intact the ball of soil containing the roots, and if two or three plants are together in one tin, no attempt should be made to separate them. When whole tins are used it is best to cut off the bottom of the tin entirely; the remainder of the tin can then be removed without difficulty, leaving unbroken the ball of soil and roots. If earth is pressed firmly around this, and a good soaking of water applied to settle it, no further attention should be required.

Propagation by Means of Layers.—Once established, the kudzu may be grown from layers which before being severed from the parent plant have rooted in the ground or have been induced to form roots in receptacles filled with soil. If preferred unrooted, runners may be detached from the parent plant and be planted direct in the place where it is desired permanently to establish the plants.

When the supply of runners is limited the first method should be adopted. Receptacles suitable for this purpose can be made from half petrol tins, which should have several holes punched in the bottom to allow surplus water to drain away. An inch or so of coarse material is put in the bottom of the tins to prevent the holes from being blocked up by the soil with which the tins are filled. This soil should contain a moderate amount of humus, which will help it to retain moisture. The tins should be rather more than half filled with this compost and then placed near to the plants it is desired to propagate from and at about three feet from the growing tips. The runners are then placed firmly on the soil in the tins and wound round so that two or more leaf-nodes remain inside the tin; these are then covered with an inch or two of soil, which must be pressed down firmly to prevent them from becoming loosened and, with the aid of the wind, gradually extricated from the tin. During favourable weather, root formation will commence within a few days, but the runners should not be detached from the parent stock until they have become well established and are growing freely. This will require at least a month, but the period will depend on the vitality of the plants and the weather conditions. When it is thought that a strong root system has developed, the parent should be severed, care being exercised during this operation that the young roots are not disturbed. If much new growth has been made, this should be shortened to one or two feet so as not to place undue strain on the newly formed root system. These new plants may then be transplanted to permanent quarters when conditions are favourable, taking care to retain the mass of soil unbroken and so avoid injury to the roots during transplanting. The growth of transplanted rooted plants is at first slow, and it is therefore well when first establishing the crop and when possible to put these out into carefully prepared and manured sites.

Much less labour is entailed if unrooted slips are detached from the parent stock and are planted direct in the permanent site, but when this is done success very largely depends on weather conditions, and a period when wet or dull weather is expected to continue for a week or more should be chosen for this work. Propagation by this method should only be attempted when a plentiful supply is available, and should not continue after the middle of February, as the young plants resulting from very late plantings have not sufficient vitality to withstand the long drought of winter. Vigorous shoots of the current season's growth give the best results; these should be traced to near the parent root-stock, severed there and drawn from among the tangled growth of smaller runners, exercising reasonable care, since bruised or broken cuttings do not grow as readily as uninjured ones. In order to reduce the transpiration of water, fifty per cent. to seventy-five per cent. of the leaves should be removed at once, leaving the remainder

evenly distributed. Strong side-shoots are shortened back to two or three leaves, while weak side-shoots are removed entirely. As the slips are prepared in this way, each should be wound into a separate coil to facilitate subsequent handlings. Unless precautions, such as packing in wet material, are taken to prevent wilting, they should be planted without delay in furrows about four inches deep which have been previously prepared. As the cutting is uncoiled on to the bottom of the furrow, an inch or two of soil is thrown on to it, and is trodden down by the planter who walks in the trench as the planting proceeds. It is important that this soil should be pressed into close contact with the slip so that it is enabled to maintain its vitality by absorbing moisture from the soil until roots have developed. The leaves which were left on and the growing tip should not be covered, and if desired the part of the runner to which the leaf is attached may protrude above ground, but the portions exposed should not together equal more than about a quarter of the whole length. The furrows should be filled to the top except for a slight depression, which will serve to collect rain water.

If the weather remains favourable for a week or so after planting, some 80 per cent. of the cuttings may be expected to "strike," each producing several young plants, which will appear above ground at intervals after two weeks from the date of planting.

When the plant has become well established, its prostrate runners grow in all directions, sending down roots at intervals where they come in close contact with the ground, and in this way new plants are established of their own accord without special attention being given them. As, however, an even stand in which the whole surface of the ground is covered with rooted plants is more desirable than the patchiness which results if the plants receive no further attention, it is advisable to bury these runners as they grow an inch or two deep and to within a foot or so of the growing tips. This prevents them from being blown about by the wind, is conducive to the formation of roots and the rapid establishment of new plants at nearly every leaf-node.

If the newly formed runners are buried at intervals of two to three weeks during the growing season, they will grow apace, and in this way the original line or plot may be extended to many feet on either side each season. During the exceptionally dry season of 1921-22 many established plants on the Experiment Station at Salisbury grew to over 50 feet in length in six to seven months. It is calculated that each of these with its subsidiary branches will have produced upwards of a hundred new plants in the season.

As it is an easy matter to establish kudzu in the above manner, it is thought that where there is a well established plant to draw on, and where it is desired to grow the crop on a large scale, it will be more satisfactory to first establish single lines of plants at comparatively wide distances apart, and meanwhile to grow other crops between these lines until such time as the kudzu has extended itself over the whole area.

Pasture Plants and Grasses in Rhodesia.

RESULTS OF FURTHER TRIALS.

In the April *Journal* we published an article on grasses of agricultural importance in Southern Rhodesia. The following notes dealing with some of these grasses have been compiled by the Chief Agriculturist from reports sent in subsequently by farmers who have had the varieties under trial for two or more seasons and who are therefore in a position to speak with some certainty on their relative values. Such reports are of the greatest possible assistance, both to officers of the Department and to the public in general, enabling, as they do, all concerned to keep in touch with the manner in which various grasses and pasture plants are continuing to *make good* under different conditions of soil and climate. Large numbers of parcels of roots and seeds of these perennial plants are issued yearly. The results of the first season's growth are generally reported upon on the special forms sent out with each consignment of seed. With perennial plants, however, these preliminary reports are of little real value, as under no circumstances can conclusive opinions be formed until two or three seasons have elapsed. We would therefore appeal to all farmers who have tested such plants and grasses for a sufficient length of time to supply the Department with reports on their behaviour and value, framed on similar lines to the following:—

GRASSES ON MR. H. B. CHRISTIAN'S FARM, EWANRIGG, ENTERPRISE DISTRICT.

Rhodesian Tussock Grass.—A few roots were obtained from the Agricultural Department early in 1921. As soon as sufficient growth was made, the new plants were split up and replanted early in March, and these grew into fair sized stools by the early winter. In November, 1921, the stools were again split up, averaging thirty-four plants per stool, and were planted 15 ins. by 15 ins. apart in land that had had a dressing of manure at the rate of 10 tons per acre and wood ash at 3 tons per acre, the object being to get as big and rapid a growth as possible for further increasing the supply of roots. In spite of the drought this year, no rain in January and none since the first week in February, the plants have made good growth and have seeded freely. On 3rd April some of the grass which was showing slight signs of wilting was cut, and in nine days had made a re-growth

of six inches in height. Rhodesian Timothy, Kokoma grass and native *paspalum* cut at the same time made nothing like the same growth in the time, while the ordinary veld grasses have made no growth at all.

Last winter, stock inadvertently got into the grass plots and ate this grass right down before touching kikuyu grass, Penhalonga grass or kudzu vine. The tussock grass remained green throughout the winter.

Penhalonga Grass.—Roots of this grass were obtained from the Agricultural Department at the same time as those of tussock grass, and were planted 3 ft. apart each way. By the first frosts, runners up to 12 ft. long had been thrown out and a lot of them had rooted at the nodes. The frosts cut down any runners which had not rooted; the main plants remained green at the crowns throughout the winter, but not to the same extent as the tussock grass. It is a much easier grass to establish than tussock, and in my opinion if planted 12 ins. by 12 ins. apart on good soil in a normal season would form a dense mat in the second season.

It appears to be more succulent than tussock grass, and next to tussock is preferred by cattle, mules and horses to the other grasses I have tried. The cost of establishing a pasture would be infinitesimal compared with doing so with tussock. Penhalonga has not stood the drought to the same extent as the tussock. It is not therefore so good a winter grass, and this season has made a comparatively smaller growth. It has, however, made better and different growth with me to what it has done at the Salisbury Experiment Station and is more inclined to form a turf.

Kikuyu.—This grass I have had under trial for four years with very satisfactory results for the first two years, after which it rapidly deteriorates. Stock eat it readily, but prefer tussock or Penhalonga grass. If these latter grasses make the same vigorous growth year after year, I would not plant any more kikuyu. A top dressing of manure in the third year at the rate of 25 tons per acre in 1921 did not improve the kikuyu to any great extent.

Kudzu Vine.—Runners were obtained from the Department in February, 1920. In 1921 there were about twenty well established plants which made splendid growth, and this year the ground is covered by the vine to the same extent that it is at the Salisbury Experiment Station. Kudzu has felt the drought less than the grasses. So far, except when the cattle got into the plots and when they wouldn't touch the kudzu vine, I have not tried feeding it to them. I am inclined to think that if it could be made into hay or silage they would eat it readily, but with the long runners I do not quite see how a hay rake could be worked on it. My experience with the legumes is that neither cattle nor horses are very keen on velvet beans, haricot beans, monkey nuts or native vaal bush (which is a legume) when they are green and growing, but when made into hay they eat them greedily, including the vaal bush.

GRASSES UNDER IRRIGATION ON BRITISH SOUTH AFRICA
COMPANY'S MAZOE CITRUS ESTATE, MAZOE.

Rhodesian Tussock Grass.—Eighteen roots were received in February, 1921, and in October these had grown sufficiently to be split up and planted out a plot one-eighth of an acre in extent, in rows 3 ft. apart, the plants being spaced 1 ft. apart in the row. Between the date of planting and the date of this report (25th June) the plot has been twice irrigated and twice cut for green fodder. The grass has reached a height of 3 ft. and has formed a solid stand, each plant having stooled strongly. Tussock grass has done best of any of the grasses. It has continued to make vigorous growth right through the winter, and is not affected by frost in spite of the plot being situated low down on the banks of the river. It would appear to be a valuable winter grass providing good feeding.

Penhalonga Grass.—About thirty runners were sent to the estate in February, 1921, and as in the case of tussock grass, these had made sufficient growth by October to plant out a plot one-sixth of an acre in area; rows 2½ ft. apart and the plants 1 ft. distant in the row. Treatment was similar to that accorded to tussock grass, but Penhalonga was only cut once in April, 1922. It reached a height of 6 ft. and has now formed a solid mass of growth similar to that made on the Salisbury Experiment Station. This grass has proved a very vigorous grower during warm weather. Frost cuts it down, but as soon as frosts are over it rights itself and goes ahead again.

Swamp Couch Grass.—Twelve runners were received in February, 1921, which by October had made sufficient growth to permit of a plot one-eleventh of an acre in area being planted out; planted in rows 4 ft. by 1 ft. apart. Since October, 1921, it has been irrigated three times, and while spreading over and covering the ground, has also made an upright growth 2½ ft. in height. It has not yet been cut for green fodder. Stands the frost well and makes rapid growth during the warm weather.

Buffel Grass.—Twenty-four plants were received in February, 1921. These were split up again in October and provided sufficient sets to plant a one-twentieth acre plot; planted in rows 2 ft. apart, the plants 6 ins. distant in the rows. Between the date of planting and the present date the plot was twice irrigated and three times cut for seed. This grass has made an excellent stand and has reached a height of 5 ft. One such growth was made in two months—between the end of December, 1921, and the end of February, 1922. This grass is cut back by frost, but immediately recovers when the weather becomes warm again.

Kudzu Vine.—Two ounces of seed were received on 14th February, 1921. Seventeen plants were successfully raised and were kept in tins throughout the following winter. In spring (November) they were planted out in the open ground 6 ft. apart each way, and have since been irrigated four times. Growth was slow to commence with, the plants seeming to take a long time to get a hold of the ground. When once well rooted, satisfactory progress has been made and many runners

from 8 ft. to 15 ft. in length have been thrown out. The plot has not yet been cut or grazed, and it is not possible to report further on the value of this crop until it has been established for another year.

GRASSES AND PASTURE PLANTS ON CAPTAIN J. M.
MOUBRAY'S FARM, CHIPOLI, SHAMVA
(Altitude 2,500 ft.).

Paspalum dilatatum.—This grass has done extremely well for a number of years. Unaffected by frost.

Kikuyu.—This grass is doing very well in good ground, but has not the drought-resisting powers of *Paspalum dilatatum*. Unaffected by frost.

Paspalum dilatatum and Kikuyu.—In good moist ground these are forming an ideal mixed pasture, both thriving together (after two years). If the ground became very dry I am inclined to think the *paspalum* might kill out the *kikuyu*, but the pasture has not been long enough in existence to make a definite statement.

Swamp Couch Grass.—This native grass grows in most moist places and in the sandy ground along the river bank. It gives place, however, to both *paspalum* and *kikuyu* and does not grow as strongly as either of them with me.

Napier Fodder.—This, planted where swamp couch grass existed, is gradually killing it out. Napier fodder appears to do much better when planted in cultivated ground than it does growing in a state of nature along the river banks. Produces wonderful results on red soil when irrigated.

Phalaris bulbosa.—A great deal of trouble was taken with this grass. It was removed from land to land when doing badly. It grows fairly well in good moist soil, but cannot stand any drought. On dry land a few plants here and there survive, but these are being gradually over-run by other grasses and are disappearing. Have decided after three years' trial that this grass is not suitable for Chipoli.

Native paspalum.—Common along the river, but not nearly as vigorous a grower as *P. dilatatum* or *P. virgatum*.

Paspalum virgatum.—Planted in slips along an irrigation channel. Makes great growth, but stock do not eat it till other grasses become scarce. This may just be because there is as yet not much of it.

Florida Beggar Weed.—Does extremely well, especially in red soil, when irrigated.

KIKUYU ON MR. D. R. R. PYEWELL'S FARM, GLENARY,
GUTU DISTRICT.

Six roots were received from the Department in 1919. It does best on sandy vlel soil which does not get too wet. Under such conditions frost does not affect it much, and even though nipped by hard frost, it immediately afterwards throws out fresh leaves and shoots. After being frosted on *dry* soil it remains dormant until the next rains.

Last season I put in about eight acres of kikuyu in a paddock where five donkeys, two mules and one horse run by day and sixteen oxen most nights. In spite of the drought and animals eating it down to the roots, it is alive and flourishing (June, 1922).

I find that if they can get kikuyu, animals will eat nothing else, and if over-stocked they keep it so low that the wild couch grass smothers it. I cannot get it out of the piece of land in which I originally put the few runners sent me by the Department, although I have ploughed it over many times. All stock, even pigs, eat it readily.

KIKUYU ON MR. A. G. LAKE'S FARM, MORIA, HEADLANDS.

The kikuyu grass was first planted in December, 1919, in a moist sandy vlei. It has received no special attention and is constantly grazed by stock. It remains green throughout almost the entire year. Reporting again in May, 1922, Mr. Lake writes:—"The kikuyu here is still going along well in spite of drought, etc. (rainfall this year 14.68 ins.), and is at present green, although we have had some heavy frosts. The cattle keep it grazed close, and I should say it would make very good grazing for sheep."

KIKUYU ON GILSTON FARM, NEAR SALISBURY.

On very wet sandy vlei soil it has not done well. On the edges of such vleis it has established itself well and is making good growth. A patch on manured land is doing excellently. Frost does not seem to affect it, provided there is moisture in the soil.

GRASSES ON MR. C. RADCLIFFE'S FARM, HISTONHURST, VICTORIA.

Kikuyu.—Along the banks of the furrow on rich land manured and periodically covered with silt the grass does particularly well and reaches a height of 12 ins. The growth is dense, matted and vigorous, and tends to encroach on the irrigated land. On moist vlei sandy soil without manure it has not made much growth, but keeps green.

Penhalonga and Tussock Grass have done well on rich manured land, but when transplanted to poor dry sandy loam have failed. The rainfall this season has only been about twelve inches.

The Shows.

BULAWAYO.

The Bulawayo Show was held on the 30th and 31st May, and despite adverse circumstances, such as the drought and the slump in the price of cattle, the event was an undoubted success. Although no cash prizes were given this year, the classes were well filled, and there were probably more animals of outstanding merit than have ever before been exhibited at Bulawayo. A strong contingent of animals was sent up from the Union, and His Honour the Administrator, who opened the Show, paid a tribute to the sportsmanlike spirit of the exhibitors in sending their valuable stock to Rhodesia. They scored some notable successes, which included the winning of the Thousand Guineas Trophy by Capt. H. L. Phillips with his magnificent Aberdeen Angus bull, "Village Editor." This is the first time a competitor from outside the Territory has won the trophy. We tender our hearty congratulations to Capt. Phillips. The Herefords took pride of place as regards numbers and quality. The females were of exceptional merit, and were described by the judge as the finest he had seen in Africa. The judge also referred to Mr. Jobling's "Dovenby Druscilla," the champion female in the Show, as the best Hereford in South Africa. Mr. Jobling was as usual a successful exhibitor, and his awards included seven firsts in eight classes and several championships. His "Dovenby Dogma" was awarded the certificate for the best Hereford bull in the Show, while "Dovenby Druscilla" secured further honours as the best Rhodesian-bred Hereford cow or heifer. The Asbestos Cup for the best bull with five of his progeny—a searching test—went to Mr. Jobling with his exhibit of Herefords. The championship certificate for the best Hereford cow three years and over went to "Sandown Surety," owned by Messrs. Cooper and Nephews.

The Shorthorn classes were not so well filled as they might have been, but the quality was excellent. "County Magistrate," the winner of the Thousand Guineas Trophy in 1920 and runner-up this year, was a conspicuous figure, and his successes included the Challenge Cup presented by the Shorthorn Society of South Africa for the best Shorthorn or Red Lincoln animal, the award for the best Shorthorn bull, and the championship for the best Shorthorn bull. Messrs. Drummond Forbes and Freeze, the owners of "County Magistrate," also produced the winner of the Alexander Cup for the best Shorthorn female over twelve months eligible for entry in S.A.S.B. in "Dornoch Baroness." The John Roderick and Co.'s cup for the best South African bred bull the property of a private farmer or rancher was won by Mr. A. E. White with his Shorthorn bull, "Gordonville Parol."



"Blaaukrantz Molly II.," champion Friesland cow at Bulawayo Show.



"Avoca Avateer," champion Friesland bull, Bulawayo Show.

In the Devon classes Messrs. A. E. and L. Bingham won the Resident Commissioner's Cup for the best North Devon animal with "Highfield Cinderella," bred by Mr. C. Morris, of St. Albans, England. The Trevelloe Estates secured the medal presented by the South Devon Herd Book Society of England for the best group of South Devons (pedigree), consisting of one bull and four females. "Village Editor," the winner of the Thousand Guineas Trophy, was supreme in the Aberdeen Angus classes, and annexed the silver cup presented by the Aberdeen Angus Cattle Breeders' Association of Great Britain for the best animal of the breed. "Village Editor" is considered to be the best Aberdeen Angus bull ever seen in South Africa, and in the opinion of Mr. Abbott of Natal, he and "County Magistrate" are probably the two best bulls in the country to-day.

The Friesland Cattle Breeders' Association of South Africa achieved conspicuous successes with the animals brought up for sale, winning the male and female championships in the Friesland classes, together with five first, two second and three third prizes.

The sale of pure-bred cattle which took place after the Show was well attended, and a very considerable sale of animals at moderate prices took place. There was little demand for highly priced stock, and several, including "County Magistrate," were withdrawn. The highest price realised by any individual animal was that paid for "Dovenby Dogma," which changed hands at £375, a record price for a sale in Rhodesia. Other high priced animals were "Gordonville Parol," sold to Mr. Webb for £140, and a Friesland female sent up by the Friesland Breeders' Association sold also for £140. The animals entered for sale by the latter sold readily, the heifers fetching very good prices. The bulls were not in such demand, and were disposed of for prices ranging from £42 10s. to £75.

The sale demonstrated the wide and increasing popularity of the Hereford breed in Rhodesia. The Devons offered for sale were disappointing in quality. The breeders in the south would do well to follow the good example of the Friesland breeders and send up animals of better quality. The sale, which realised over £9,000, gave proof of the confidence of the farming community in the future of the country.

In the course of his speech at the opening of the Show, His Honour the Administrator said it had been decided that breeding stock exhibited at Bulawayo Show would be admitted to Northern Rhodesia after a period of quarantine on the Show ground of one month from the last day of the Show.

Pigs.—The pig entries formed an important feature of the Show. The entries were fairly large, but, speaking generally, the condition of the animals was hardly up to the standard of previous years. This was only to be expected, as the drought and high prices of pig feed have militated against the pig breeding industry throughout the Territory. The valuable cup presented by the English Large Black Pig Society went, after considerable competition, to Mr. R. Asserman, whilst the Large Black Challenge Cup (to be won on points), presented by Mr. Leo Robinson, went to its donor. Mrs. A. Cadman was the

principal winner in the classes for Berkshire pigs. This lady was also successful in the Large Black classes, and gained (with cross-bred pigs) the prizes both for bacon pigs and porkers.

Maize.—Unfortunately the date fixed for the Show is much too early in the season to permit of good maize exhibits, and owing to this fact there were few entries. In the classes for Hickory King, 8, 10 and 12 rows, Dr. Arthur Pearson secured premier honours; his selection to type and uniformity was especially good. In the Salisbury White classes the entries were few and the ears exhibited were below the standard required for this variety.

Produce.—The produce classes were weak in number, but great improvement was shown in quality in almost every instance. The wheat classes in particular deserve mention on account of the excellence of the exhibits; it is obvious that farmers are paying increased attention to this crop, which is attaining an importance which is more in keeping with its value. Sunflowers formed another excellent exhibit, and seemed to show that this is one of the few crops that succeeded in withstanding the drought. The class for "any meal, pure or mixed, made by a farmer for cattle feed," was an excellent innovation, and deserves the compliment of imitation at other shows. It invites and taxes the ingenuity of the farmer in preparing and mixing food that shall be both palatable and a good ration for the various farm purposes. The root classes were more than fair when the season is considered, and as usual the majorda melon proved a prominent feature of the Show.

Probably the most striking exhibit of farm produce ever staged at a Bulawayo Show was the collection of fodder and feed crops from the municipal dry land experiment station. It was late in the season when the station was taken over, and it was impossible to get the land into really good condition in time for seeding. In spite of this disadvantage, and the fact that of the total rainfall of approximately 14.5 inches not more than 3½ to 5 inches actually fell on the crops after they were sown, the failures were negligible and the successes remarkable. The results bore eloquent testimony to the wide range of feed crops which can be grown in Matabeleland in a normal season.

Dairy Produce.—The dairy produce was not a strong feature of the Show, mainly because of the drought. There was a fair display of farm butter, but the quality was hardly as good as in previous years. Some exhibitors again made the mistake of undersalting their butter, whilst, on the other hand, one or two exhibits were oversalted or the salt was not properly dissolved. Another feature, due no doubt to the drought, was the marked absence of colour in the butter.

It is to be regretted that there were no entries in the prize list for creamery butter. It is to be hoped that this deficiency will be rectified at next year's Show, as creamery butter is being largely sold in the Territory, and the value of the exports is increasing rapidly.

Cheddar cheese was fairly well represented, and it is interesting to note that all the cheese except the first prize exhibit came from Rhodesia. The winning exhibit was sent by the Rocky Ridge Cheese Fac-

tory, Kokstad, and the second prize was gained by Harley's Cheese Factory, Beatrice.

Citrus Fruits.—Most of the exhibits of citrus fruits were from Mashonaland, but proof was forthcoming that, given sufficient water and suitable conditions as regards soil and position, Matabeleland can grow oranges of good quality. Messrs. Knight and Folkstad, of Hartley, were successful exhibitors, and showed a very fine collection of all kinds of citrus fruits. Their naartjes were quite equal to the best Cape product. Scale was present in the fruit of certain exhibitors, and these exhibits were, of course, ruled out.

Poultry.—The show of poultry constituted another record in number and quality of exhibits. The entries totalled 783, of which 680 were fowls, ducks and turkeys, the balance being made up of appliances, foods and children's essays. The poultry hall has been much enlarged, and is now the largest in South Africa. A number of birds were sent up from the Union and some from England. Notwithstanding the competition from other parts, the majority of the awards went to Rhodesian-bred birds.

White Leghorns took premier position as regards numbers, but the quality was not fully representative of the birds in the country. Rhode Island Reds came second in point of numbers, and there were big classes also in White Wyandottes, Anconas, Light Sussex and Orpingtons, the quality being good.

A number of Rhodesian birds exhibited at this Show competed later at Johannesburg in the South African championships, and did remarkably well.

The classes for the best essays on the hen were well patronised, and produced some praiseworthy efforts. This is the first time these classes have been introduced, and it is an innovation which is well worthy of extension.

A number of birds were claimed at catalogue prices, and where more than one claim was received, the birds were put up for auction. A pen of White Wyandottes (one cockerel and two hens), sent by Lord Dewar from England, was claimed by Mr. Peake, of the Umvukwes, for £35.

CWELO.

Gwelo, after a lapse of five years, and in spite of drought and East Coast Fever, revived its Show, which was opened by the Administrator on 6th June. As he remarked on that occasion, the society has in the face of difficulties got its organisation into trim, and can now look forward to future successful Shows. It is not surprising that in the circumstances the number of the exhibits was not large, but the quality of the cattle and pigs was excellent. A most interesting exhibit from Lalapansi district, collected from a number of farms and most effectively staged by Mrs. McAllister, attracted great attention, and deserves to be imitated by other groups of farmers who desire to call attention to the possibilities of their neighbourhood and to secure mar-

kets for their wares. Similarly, Mr. Williams, of Selukwe, with the help of his son, exhibited seventy different items grown or made on the farm, showing how largely self-supporting one can be and what a great variety of commodities can be prepared on even one farm. The exhibits of the Department of Agriculture attracted much attention, the close and prolonged study devoted to them by interested visitors amply justifying the undertaking.

The chief breeds of beef cattle exhibited were North Devons, belonging to Mr. A. Coles, and Aberdeen Angus, belonging to Mr. J. R. Stewart, of Shangani. Herefords were poorly represented. The group class was won by Mr. J. R. Stewart with his Aberdeen Angus cattle, headed by "Black Band II. of Castlecraig," an imported bull of great quality, which was awarded the championship for the best bull in the yard. This progressive breeder also produced the champion cow in "Village Evelyn." Mr. A. Coles secured the second award with a fine string of his North Devons, headed by "Highfield Reminder," which won the championship in his class both at Bulawayo and Gwelo.

The milking competition was won by Mrs. J. Ferguson's Shorthorn cow, which tied in weight of milk produced with a Friesland belonging to Mr. C. F. Anthony. The latter cow, however, was disqualified, owing to the butter fat percentage being below the standard laid down.

Considering that Gwelo is the chief centre of the dairying industry in Rhodesia, the dairy exhibits might have been more numerous. The exhibits of farm butter were well got up, but in some cases were overworked, thus spoiling the texture of the butter. If the butter is dry-salted, guessing the quantity of salt required should not be indulged in, as a definite amount of $\frac{1}{2}$ oz. salt to 1 lb. of butter is the proportion usually advised as being acceptable to the public. The first-prize butter, that of Mrs. Elsworth, of Kubri farm, Que Que, was a fine sample of farm butter, well made up and tastefully displayed.

Like the Bulawayo Show, the Gwelo Show was held too early in the season to expect strong competition in the maize classes. The wheat classes were few in number, but the quality was excellent, Mr. T. H. Davison, of Grootfontein farm, Umvuma, being first with a fine, plump sample of Gluyas Early. The same exhibitor also secured a special prize for barley wheat (Nepal barley).

The poultry were good in quality, but disappointing in number. Instead of the 60 entries which faced the judge, there should have been at least 260. Those who did show well deserved the honours awarded, and Mrs. Pinches, of Gwelo, and Mrs. Renton, of Que Que, are to be congratulated on their wins, the former with White Wyandottes and the latter with White Leghorns.

There was only one turkey, an excellent bird shown by Mrs. Buckley, of Lalapansi. The egg classes were very poor, there being only four entries; the quality was fair. It is much to be hoped that next year poultry breeders from the whole of the Midlands and beyond will make a point of supporting this Show as they should do.



"Highfield Reminder II," owned by Mr. A. Coles. Best imported Devon bull, Bulawayo and Gwelo Shows.



'Black Band 2nd of Castlecraig," owned by Mr. J. R. Stewart, best Aberdeen Angus bull, Gwelo Show.



"Molly's Buringa of Gloria," owned by Mr. W. F. Summers, best Friesland bull, Gwelo Show



Lalapansi farmers' exhibit, Gwelo Show.

RUSAPE.

Rusape is a centre for a wide farming district, and the Show continues year by year to expand and to improve. It is now regarded as an agricultural and social gathering of real importance. The value of district Shows is becoming more and more manifest. Many attend who cannot visit the two chief Shows in the country; much useful exchange of ideas takes place and much is learnt and imparted. The products of the country are demonstrated, progress is measured, possibilities are suggested and people interested in the same subjects meet one another. The greater Shows are benefited rather than injured by these local Shows.

The Rusape Show has achieved much for the district, and the number of new farmers in the locality is a healthy indication of future progress.

Considering the abnormal season, there was quite a fair show of cattle, and most were in good, if not in tip-top, show condition. The champion bull in the Show was "Bilsington Royal Favourite," a Shorthorn belonging to the Inpinge Estates. The runner-up was a Shorthorn bull bred locally by Mr. S. H. Harnden, of Silver Bow. The award for the best dairy bull went to Col. Knapp with a Friesland.

The display of dairy produce was good considering the season. The first prize for fresh butter went to Col. Knapp, and for cheese-making to Mrs. MacLagan.

In spite of the drought of the past season, a good display of produce was exhibited, and competition was keen in the maize classes. The chief prize-winners were Messrs. L. Lloyd, Gorubi Springs, Inyazura; A. Curling, Dunholm, Inyazura; and V. R. Harris, Westacres, Odzi. An outstanding bag of wheat was staged by Mr. W. H. Hacking, York farm, Inyanga. It was a distinct credit to the grower. Mr. S. H. Harnden, Silver Bow, Rusape, exhibited an exceptionally fine collection of stock foods, for which he was awarded a first and special prize.

The poultry classes were fairly well filled, and the quality of the majority was good; especially was this the case in the heavy breeds, which it is gratifying to see are becoming more popular in this district. They were represented by White Rocks, a very fine cockerel of this breed, owned by Mr. Taylor, of Rusape, being awarded the special prize for the best bird on the Show. Black, Buff and White Orpingtons were also shown, a fine Black Orpington pullet, owned by Mrs. Bernard, of Headlands, winning the special prize for the best female on Show. Rhode Island Reds were also well represented.

Light breeds did not show the same quality and condition as did the heavy breeds, although there were a few good birds among them, notably Mr. O'Linn's White Leghorn cockerel, which was awarded special prize for the best Leghorn. Ducks were only fair. Turkeys were good. The entries in eggs were only fair, although the quality in the majority was good. There should have been far more entries in these classes than there were.

Many birds lacked condition, and this is a fault seen at most Shows. Some birds showed signs of scaly leg, others broken or cut feathers, and others again were infested with sand fleas. Some birds were too fat and some too lean. All these faults can easily be remedied by a little care and attention.

UMTALI, 29th JUNE.

The Umtali Show is a long-established institution, and serves in many useful ways to call attention to the agricultural and industrial activities of the eastern border.

The entries of cattle were fairly numerous, the beef breeds being well represented. The Inpinge Estates repeated their success at Rusape with "Bilsington Royal Favourite," which gained the championship for the best bull in the Show. The Longlands Cattle and Tobacco Farms, Ltd., exhibited a choice Hereford bull, which was the runner-up for the championship. Messrs. Strickland, J. Meikle and Barry gained most of the awards in the other sections.

There was a good display of dairy produce, especially in the butter classes, there being no fewer than 28 entries. The awards for the best butter went to Mrs. Cockerell and to Miss M. Harvey. A nice sample of cheddar cheese was exhibited by Miss Isobel Mitchell, of Odzi.

The Show was well representative of what Umtali can do in the produce line. There was a very good display of mealies; the selection to type and breed were good and the staging excellent. A better all-round collection of maize has never been exhibited at Umtali.

In the bean classes the competition was keen and the quality excellent.

Although the classes in the citrus fruits section were not so well filled as usual, the quality of the fruit was better, if anything, than that of previous years. In some cases exhibitors might show more care in picking their fruit by clipping the stalks shorter. Individual exhibits should be of as even a size and shape as possible; in any case exhibitors should make sure that the fruit sent in is of the type it is supposed to represent. On the whole the display was disappointing by reason of the fewness of the exhibits. The exhibit of fruit taken from a box that was packed in early May and drawn out of a consignment packed for export to England showed the good keeping quality of our fruit. This fruit was in perfect condition.

Timber in plank, packing cases, shooks, hubs, naves and felloes and furniture was a conspicuous feature, clearly demonstrating possibilities in this direction in our mountains and in the adjacent Portuguese territory.

The poultry this year were housed in the new poultry hall, which is one of the best in South Africa; certainly the second best in Rhodesia. It is capable of holding comfortably 400 birds; unfortunately only 79 were entered. The Poultry Expert, who visited a number of the poultry yards, saw numbers of excellent birds, the owners of which did not take the trouble to enter. Nearly half the birds shown were entered

by Mr. Bland and Mr. Kidwell (the former 21, the latter 17), who well deserved the prizes they received, both for the quality and condition of their birds and for their progressiveness in putting up such fine entries. It is to be hoped that all poultry keepers will follow their example next year.

The quality of the birds on the whole was good, although there were a number that had the following blemishes: Lack of condition, scaly leg, broken and cut feathers, lack of flesh and over-fatty condition.

White Leghorns predominated in numbers, and on the whole were of excellent quality. White Rocks, although few in number, were good; the same can be said of Rhode Island Reds. Ducks also were good. There were only two turkeys, but these were excellent.

Egg classes were very disappointing, there being only six; there should have been at least 26, considering the number of eggs produced in the district. The quality of these was fair, but more attention should be paid to uniformity of size and shape. Only one exhibitor, viz., Mr. Tatham, came forward in the classes, grain and green foods, and he is to be congratulated upon his exhibits, especially those of lucerne meal and monkey nut leaf meal. His home-made trap nest too was excellent, and received a well-deserved special prize. It is to be hoped that next year the new poultry hall will be filled.

LOMAGUNDI DISTRICT SHOW, 7th JULY.

The Sinoia Show is characterised by an atmosphere of sociability, and is made the occasion for meetings and sports of various kinds. At the same time the agricultural element is dominant, and the Show has in the course of the five years of its existence grown from small beginnings to quite an important local event. Maize and cattle exhibits constitute the chief attractions, but other features are not neglected, and the exhibition affords an interesting index of the farming activities of the Lomagundi district.

The co-operative spirit of the Lomagundi farmers in working together in the face of difficulty was manifested in the temporary building for housing the exhibits and in the large number of exhibits of very creditable quality.

Sir Francis Newton, in opening the Show, admitted he was wrong in the view he once held that instead of holding local Shows, it would be better to concentrate on the larger central Shows, such as Bulawayo and Salisbury. He now considered that these smaller Shows did a great deal of good locally. He refuted the statement that this country had not made the progress it should have made, and contended that from the year 1904 the country had never looked back. That progress they were maintaining now. Sir Francis Newton, in referring to the high quality of our maize, paid a compliment to the Department of Agriculture for the part they had played in achieving this result. He mentioned that he had received an assurance from a friend of his at Home in a position to judge that Union and Rhodesian maize still

holds its premier place as a staple article in the manufacture of starch and dry gin. He urged the necessity for maintaining the high standard of excellence secured. In regard to beef, Sir Francis Newton considered the immediate prospect was not a happy one, and expressed the hope that in time matters would adjust themselves and become normal in the markets of Europe once more.

Competition in the produce sections was good, especially in the classes for maize, ground nuts, sweet potatoes, velvet beans, pumpkins, cattle melons and dry fodders. In spite of light rainfall, some of the maize exhibits were fully equal in weight and quality to those of past seasons. Ground nuts appeared to have suffered most, and all exhibits of these contained numerous shrivelled kernels. The fruit classes were of prime quality, and the awards were shared between Mr. Abbot and the B.S.A. Company's Sinoia citrus farm.

The dairy produce made a fair show, but more entries might have been looked for in this coming dairying district. Mrs. Struthers was awarded prizes for fresh and salt butter, whilst awards for cheese were gained by Mrs. Eldred and Mrs. Richards. Mrs. Kidwell exhibited some choice cream cheese.

The poultry were very disappointing. With the exception of two or three Black Orpingtons and one or two Rhode Island Red cockerels and a few turkeys, there was nothing of any real quality on the show. The condition too of the majority of birds left much to be desired. Many were suffering from scaly leg, some had sand fleas, and many were put on with broken and cut feathers; the result was that a number of prizes had to be withheld.

Several birds in the Leghorn and Rhode Island Red classes were not pure bred; in fact, only one Leghorn and two or three Rhode Island Reds of those shown could aspire to this honour. Of the Black Orpingtons, the few entered were good. Turkeys were the best filled classes, and the majority were good.

The egg classes were good as far as number of entries went, as was the quality of some; others showed lack of uniformity of size, shape, colour and also of cleanliness.

It is to be hoped that at next year's Show there will be a great improvement in the quality of the birds and the number of entries, and that those entering birds will see to it that they are in good condition. A little care, attention and trouble are necessary, and the results will be well worth it.

The Cattle Industry.

By ERIC A. NOBBS, Ph.D., B.Sc., F.H.A.S.

The annual review of the frozen meat trade issued by Messrs. W. Weddel & Co., Ltd., is a regular landmark for all connected with the cattle industry throughout the world. This year we have not received a copy direct, and owe to that useful trade periodical *Ice and Cold Storage* the following extracts. No apology is made for quoting freely, since neither we nor our farmer readers have other means of obtaining the most important information here brought to a focus.

It would appear that the year 1921 was a disastrous one for the meat industry. The Continental trade was a disappointment, mainly owing to inability to buy at prices in any degree remunerative to producers, and in consequence meat from all quarters was diverted to the British market, itself already over-stocked. Yet the total quantities of meat consumed by the British public are truly enormous. The report states:—

“Frozen mutton and frozen lamb from all sources; importations into the United Kingdom aggregated 16,179,770 carcasses, as compared with 12,487,129 carcasses in 1920, an increase of 3,692,641 carcasses or 29.6 per cent.

“*Frozen Beef.*—Arrivals last year amounted to 5,108,900 quarters, as compared with 4,871,490 quarters in 1920, an increase of 237,410 quarters or 4.9 per cent. Australia sent 621,241 quarters more than in 1920, and New Zealand shipments showed an increase of 141,709 quarters. Argentine supplies were reduced by 373,771 quarters, but imports from Uruguay showed an increase of 23,859 quarters. From the United States 21,012 quarters were received (*via* Sweden), against 59,820 quarters imported in 1920. Canada sent 4,335 quarters, as compared with 90 quarters in 1920.

“*Chilled Beef.*—A further large recovery in this trade has to be recorded for 1921, the total importations amounting to 1,883,362 quarters, against 510,817 quarters in 1920, an increase of 1,372,545 quarters or 268 per cent. The Argentine Republic shipped 1,709,271 quarters, as compared with the preceding year's total of 473,812 quarters; and from Uruguay 167,047 quarters were received, against 37,005 quarters in 1920. After a lapse of three years North America resumed small shipments of chilled beef, 5,003 quarters coming to hand from Canada and 2,041 quarters from the United States.

"The total imports of beef from all sources represent the carcasses of (say) 1,748,000 animals, as against 2,973,000 home-grown cattle estimated to have been killed for marketing in 1921."

The report also discusses future prospects, but from the consumer's standpoint rather than that of the Colonial producer.

"General Outlook.—So far as the supplies are concerned, the outlook is by no means re-assuring. In the case of beef it may be less disconcerting than in the case of mutton and lamb; but in neither is there any promise of abundance in the near future. It may be taken for granted that, under ordinary conditions, home supplies of beef will be relatively short in the coming year, for the reason that the number of cattle in the country of suitable age for slaughter is greatly reduced. Home mutton must also be scarcer, because the flocks are standing still or receding relatively to the population, which in ten years has increased from 45,000,000 to about 47,000,000 persons.

"Apart from the home supplies, the United Kingdom draws more or less freely from eight overseas countries. The herds in these countries numbered 163 million head in 1911 and 178 million in 1921, while the flocks which aggregated 326 million head in 1911 now total only 261 millions. Only comparatively small percentages of these animals can be exported, and it must be recognised that mere numbers are not so important as financial results in determining the volume of supplies destined to reach this market. Even if the flocks and herds which could be drawn upon were much greater and were increasing more rapidly than they are, there could be no certainty of large importations resulting; but with comparatively stationary live stock figures and a steadily-increasing population, the position of supplies, broadly speaking, must be deemed unsatisfactory from the consumer's point of view.

"The general outlook as regards the world's 'demand' is not, however, so unfavourable for the British consumer. Two years ago there existed an important and apparently assured Continental trade. A year ago its position was becoming somewhat unstable. By the middle of 1921 it had become of no great importance, and by the close of the year it had shrunk to very small dimensions. The principal reason for this withdrawal from the market must be sought for in the post-war financial condition of Europe rather than in any definite lack of desire on the part of Continental people to import refrigerated meat. It is impossible at present to say when stability in the exchanges is likely to be restored, but until that barrier to trading is removed, importations of meat are not likely to be renewed in any volume.

"The opportunity of opening up Continental markets created by the war was unique; and although the check now met with may be a fortunate happening for the British public, it is a serious misfortune for producers generally, and especially for those in the southern hemisphere who have enlarged their plants and widened their whole outlook in anticipation of a big demand from Central Europe.

"The United States is more likely to import than to export meat in any quantity, and a revived enquiry for New Zealand mutton and

lamb from American buyers is not unlikely to arise, despite the heavy tariff recently imposed.

"Turning to the home market, there are undoubted evidences that a strong consumptive demand springs up the moment prices reach a reasonably low level. This feature presented itself in a somewhat erratic fashion during 1921 because of strikes and unemployment; but throughout the year there was always a ready outlet for the best qualities. The undercurrent was especially noticeable in the case of mutton and lamb; but in beef also—except for the lower grades of quality—there were considerable elements of strength. That being so, and the immediate future of home live stock being very uncertain, a serious position might be created for consumers if any falling off in importations should follow the recent drop in values. Unless as much meat is imported into Great Britain as is produced in the United Kingdom, some sections of the public must go short. For these needed supplies we must look to Australia, New Zealand and the Argentine Republic. All other sources together, welcome and necessary as they are, cannot furnish much more than one-tenth of our import requirements or one-twentieth part of our total consumption.

"Not only is this country becoming more and more dependent upon outside sources for its meat supply, but considerably more than half of what must be imported comes from foreign countries. The dangers latent in this position of dependence hardly need to be pointed out, they are so obvious; but, notwithstanding the recommendations of more than one committee of investigation appointed by the present Government to report on the matter, nothing is being done officially to apply any remedy.

"While some recovery from the exaggerated depression in values established towards the close of 1921 is almost certain to be made, the average level of the past year is not likely to be approached, except temporarily. The general tendency must be towards re-establishing the popular prices of 1913. Working costs at all stages must be brought down further if producers are to be tempted to send to this market the increased shipments so necessary to keep prices at a moderate level."

Referring to South Africa, the report gives the number of freezing works in South Africa as twenty-one, with a combined capacity of 950 head of cattle per day, and storage capacity for 28,000 tons of meat. These factories are, of course, largely concerned in local supply, but the export of meat is given at only 950 tons in 1921, as against 5,645 tons in 1920 and 19,942 tons in 1919.

On 8th May a meeting took place in Salisbury of a number of representative men interested in cattle, at which it was decided, after a long discussion, to ask the Rhodesia Agricultural Union to approach the Government and urge the appointment of a Commission to enquire into the best means of establishing a freezing works in Southern Rhodesia and to determine approximately the number of cattle suitable for this purpose which would be available. This proposal implies recognition of the desirability of attracting the attention of those in

a position to initiate such a business and conduct it through its early stages.

It was realised at the meeting that the Government and farming public of the country were alive to the facts, and that it was not necessary to impress them, but rather that it was desirable that the Government should exert itself to induce representatives of commercial concerns connected with the meat industry to visit Rhodesia and satisfy themselves that sufficient suitable stock is in sight to justify the erection of freezing works, the provision of insulated trucks and refrigeration storage and lighterage at the coast, and the organisation of regular meat-carrying ocean service, as well as making the financial arrangements necessary for conducting such a business.

The management of the Beira and Mashonaland and Rhodesia Railways have announced a reduction in the rates to Mafeking on cattle conveyed from Rhodesia to the south, adopted as a temporary measure in view of the low prices ruling on the Johannesburg market at the present time.

The new scale of charges shown below is for a short truck containing ten head or more, and involves a material saving to the consignor. At the same time it is to be recollected that the distance and the duration of the journey impose natural limits on the distance which the animals can be conveyed, quite apart from any question of the cost.

The cruelty involved and the loss of weight have in other countries led to the curtailment of all journeys by train for cattle without detraining for rest to a maximum journey of 30 hours and a total period of 36 hours in the trucks. The rest needed and thus imposed has in practice been found to be desirable, and not for a few hours only, but preferably for several weeks or months.

The journey from Bulawayo to Newtown, Johannesburg, exceeds the above maximum period, apart from any question of cattle sent from beyond that point. Reduction in railway charges unfortunately cannot overcome the drawbacks of time and distance.

The railways have agreed to the following reduced scale of charges being put into operation for distances 500 to 1,000 miles from Mafeking as a temporary measure:—

Miles.	Per short truck.
	£ s. d.
Not exceeding 500	10 8 4
501 to 550	10 12 6
551 to 600	10 16 8
601 to 650	11 0 10
651 to 700	11 5 0
701 to 750	11 9 2
751 to 800	11 13 4
801 to 850	12 7 11
851 to 900	13 2 6
901 to 950	13 17 1
951 to 1,000	14 11 8

**STATEMENT SHOWING PRESENT CHARGES AND RATES
OPERATIVE FROM 1ST JULY, 1922, ON SLAUGHTER
STOCK CONSIGNED FROM RHODESIA TO
JOHANNESBURG (KAZERNE).**

To Johannesburg from	Present rates per short truck of			New rates per short truck of 10 head or more.
	10 head.	11 head.	12 head.	
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Bulawayo ...	16 18 4	18 1 8	19 10 0	16 18 4
Bembesi ..	17 11 8	18 1 8	19 10 0	17 2 6
Insiza ...	18 0 0	18 2 8	19 10 0	17 2 6
Gwanda ...	18 17 6	19 0 7	19 10 0	17 6 8
Gwelo ...	19 5 0	19 8 3	19 16 6	17 10 10
West Nicholson ...	19 8 4	19 11 8	20 0 0	17 10 10
Battlefields ...	20 10 0	20 13 11	21 2 9	17 15 0
Fort Victoria ...	21 7 6	21 11 10	22 1 2	17 19 2
Salisbury ...	22 6 8	22 11 6	23 1 3	18 3 4
Marandellas ...	22 16 8	23 1 9	23 11 10	18 17 11
Bindura ...	23 2 6	23 7 8	23 17 10	19 12 6
Odzi ...	23 13 4	23 18 10	24 9 3	20 7 1
Umtali ...	23 15 10	24 1 4	24 11 11	21 1 8

In three years the Friesland Cattle Breeders' Association of South Africa have sent to Rhodesia consignments of pure-bred bulls, cows and heifers pedigreed, with guaranteed milk records of dams, tested free from tuberculosis, and have sold them at prices often much below what could have been obtained elsewhere. This has been done through no altruism, but certainly not at an immediate profit; it is intended as a means of popularising the breed and creating a future demand. Buyers have been induced to go in for the breed by the opportunity afforded of securing at prices not otherwise possible high-class Friesland cattle of aristocratic breeding, combining with guaranteed health, constitution and strength. The association have thus compelled attention to the breed, and a number of farmers have adopted it and become regular customers both for bulls and heifers.

In addition to fourteen head sent to Bulawayo Show and sold there, it is the intention of the association to send six bulls and nine females to Salisbury Show, as was done last year. Dairy farmers should not

fail to avail themselves of these exceptional opportunities, which cannot be continued indefinitely, and secure high-class cattle at prices below what they would fetch in the Union.

The latest returns show the numbers of Friesland bulls as 284 and cows 737, a total of 1,021 pure-bred Friesland cattle in Southern Rhodesia at the beginning of the year, against 804 a year previously.

The Toon Tree.

The Toon tree (*Cedrela toona*) has been planted in various parts of Southern Rhodesia. Usually after planting scant attention has been given to it. The result is a much branched tree, which is neither ornamental nor useful. Yet, with a little attention, a well-shaped tree either for ornament or timber can be obtained. The method is so simple that it only needs to be pointed out. The usual habit of growth is for a young seedling to send up a straight shoot 4 to 6 ft. in length. During the period of vigorous growth auxiliary buds are formed and begin to develop into branches at the expense of height growth. If these branches are not removed, height growth ceases and a bushy growth results.

A simple and effective method of producing straight stems is to rub off the auxiliary buds as soon as these begin to make vigorous growth. It may be necessary to perform the operation once a month during the growing season of the first two years. The effectiveness of such treatment is shown in the accompanying photograph.

The plot of trees was planted by Mr. Jack at Mount Pleasant at the end of December, 1920. The photograph was taken on 20th May, 1922. The trees were planted 8 ft. apart each way, and the average height when fifteen months old was 9 ft.; some specimens were 13 ft. high.

In plantation form very little attention need be given after the trees are two years old. At this age canopy will be formed and the struggle for light will tend to develop good boles.—J. S. H.



Cedrela Toona trees growing near Salisbury. (See note.)

Climatic Areas in Southern Rhodesia.

By C. L. ROBERTSON, B.Sc., A.M.I.C.E., Hydrographic Engineer.

The instructive summary of the relative areas of the geological formations in Southern Rhodesia published in the last issue of the *Journal* led to the suggestion that it would be of interest to issue similar comparative summaries for the climatic areas as defined by the factors of rainfall and temperature.

Rainfall.—The map of distribution of normal rainfall in Southern Rhodesia published in the last meteorological report is the basis for the following summary. The normal mean rainfall over the whole country is 28.10 ins. The relative areas comprised within the different rainfall belts stated as percentages of the total area of Southern Rhodesia are:—

	Per cent.
Over 40 ins.	3.2
35-40 ins.	6.4
30-35 ins.	19.6
25-30 ins.	42.4
20-25 ins.	19.4
Under 20 ins.	9.0

The over 40 in. belt comprises the mountainous country along the eastern border, whilst the two belts under 25 ins. are wholly in Matabeleland, with the exception of the southern portion of Chibi district, which is also included.

The area with a normal rainfall between 25-35 ins. comprises 62 per cent. of the whole country, which is a surprisingly high figure.

The above percentages are, however, for normal rainfall which seldom actually occurs in any one year, and it is necessary to consider within what limits the rainfall may vary above or below this normal figure in an ordinary season. The standard deviation of mean Rhodesian rainfall from the normal is known to be 7 ins., *i.e.*, in any season the mean rainfall over the whole country is likely to be between the limits of 35 and 21 ins. or to vary by 25 per cent. above or below normal. Applying this probable variation to the different rainfall areas, the following ordinary extreme limits are obtained for these areas expressed as percentages of whole area:—

I. Ordinary limit for above normal seasons:

	Per cent.
Over 40 ins.	21.4
35-40 ins.	24.8
30-35 ins.	29.3
25-30 ins.	15.5
Under 25 ins.	9.0

II. Ordinary limit for below normal seasons:

	Per cent.
Over 30 ins.	3.2
25-30 ins.	12.9
20-25 ins.	41.3
Under 20 ins.	42.6

These ordinary limits may be exceeded in abnormal seasons, which may occur once in nine years.

The area (viz., 76.1 per cent.) with a normal rainfall of over 25 ins. is the portion of the country which may be ordinarily regarded as free from destructive droughts, whilst the area with normal rainfall under 25 ins. is frequently subject to them.

Rainfall and Geological Formations.—Adopting the 25 ins. normal rainfall line as the dividing line between the areas in which agriculture is possible or not owing to the rainfall factor, the following results have been obtained by superimposing this line on the provisional geological map.

The areas occupied by the various geological formations are again expressed as percentages of the total area of the country:—

	Normal rainfall above 25 ins.	Normal rainfall below 25 ins.
Granite	32.8	16.7
Karoo formation	14.7	0.6
Kalahari formation	5.4	5.8
Basement schists ("formation")	5.7	2.8
Lomagundi formation	5.6	0.1
Basalt and diorite	4.0	1.1
Umkondo formation	2.3	0.4
Great Dyke	0.7	0.1
Area not determined	0.4	0.8
	<hr/> 71.6	<hr/> 28.4

Lying in an area with a normal rainfall of over 25 ins., on the basis of Mr. Maufe's classification of the soils, it can be said then that 10.4 per cent. of the surface of Southern Rhodesia is occupied by red clay soil or rocks producing it, 55.4 per cent. by sandy soil or rocks producing it, and 5.8 per cent. by a sandy soil or one whose nature is not known.

Altitude and Temperature.—Another important factor from the climatic point of view is the mean temperature which is dependent

upon the altitude and latitude of the locality. No accurate contoured map of Southern Rhodesia is available yet, but sufficient is known to render possible an estimate of the relative areas occupied within each 1,000 ft. contour.

The following are the percentages of the whole area occupied by these contours:—

Altitude.	Per cent.
Under 1,000 ft.	1.3
1,000-2,000 ft.	14.4
2,000-3,000 ft.	19.6
3,000-4,000 ft.	40.5
4,000-5,000 ft.	21.5
Above 5,000 ft.	2.7

The relation existing between the mean annual temperatures of various localities in this country is found to vary as follows:—Plus 2.5° F. for every 1,000 ft. drop in altitude, plus 0.5° F. for every degree north and plus 0.5° F. for every degree west from standard stations. This relationship enables the provisional mean annual isotherms to be plotted.

The relative areas occupied by characteristic isotherms are as follows.—

	Per cent.
Over 70° F.	42.9
67°-70° F.	37.4
Under 67° F.	19.7

For comparison it may be stated that the mean annual temperatures of Shamva and Sinoia are slightly over 70°, Gatooma and Hartley just under 70°, and Salisbury and Bulawayo under 67°.

In areas with a mean annual temperature of over 70° F., the mean daily temperature during the hottest month exceeds 90° F., so that conditions are not very congenial in areas in which the annual temperature is much above 70° F.

Visit to Gwebi Farm.

In our last issue we reproduced a photograph taken on the occasion of the visit of farmers to the Gwebi experiment farm in March last. In doing so we omitted to mention that the photograph was taken by Mr. J. S. Loosley, to whom we are indebted for permission to make use of it.

Irrigation Notes.

Judging by the number of schemes under construction throughout the country, irrigation work during the past few months has been very brisk, and there appears every likelihood of matters continuing so until the end of the season.

The decision of the Government to set aside a sum of £5,000 from the Imperial Government loan fund for the purpose of making small loans to farmers for approved irrigation works will assist matters very considerably. It has long been felt that many small schemes of great promise have been held up through want of funds, and it is anticipated that such schemes will now be pushed forward. Regulations setting forth the terms upon which these loans will be granted have been drawn up, and are published at the end of this *Journal*. Many applications have already been received which have naturally had to wait until the regulations are issued. Farmers desirous of obtaining loans should lose no time in submitting applications.

Of the several irrigation schemes recently completed or under construction might be mentioned the following:—

Mr. J. M. Gordon, of Nyaroro, Lomagundi district, has recently completed a small dam for holding up the water issuing from a series of dolomite springs on the farm. These springs, about three in number, rise along a low ridge, and formerly found their way into a wet vlei. Mr. Gordon has now cut a furrow which intercepts the flow and leads the water into a dam, from whence it can be led out on to land for the growing of wheat and other crops.

Mr. L. Lloyd, of Hildadale, Bindura, has commenced work on a 20 ft. storage dam, and is hoping to complete same this season. The work is of some magnitude, and when completed will provide storage for the irrigation of some 20 acres of land.

Messrs. Liebig's, Ltd., of Mazunga, have in hand a small storage dam in the Mtetengwe River on their ranch. It is proposed to pump the water thus stored on to adjacent land for the irrigation of fodder and other crops. Messrs. Liebig's find that a certain amount of winter grown green feed is essential for keeping their bulls and best cattle in condition. It is possible at a later date that further schemes of this nature will be undertaken on this ranch for growing foodstuffs for topping off the animals.

Mr. H. Smetham, Fairview, Old Umtali, has in hand a small scheme from the Umtali River for the irrigation of about 40 acres of good red land on the right bank of the river.

The Umtali River has very considerable possibilities for irrigation, and one looks forward to the day when the rich lands of this valley will be much more intensively developed than is the case to-day.

Messrs. J. and H. West, of Frogmore Ranch, Glendale, have under construction an irrigation furrow for taking water from the Ruia River for the irrigation of about 100 acres of land which has been reported upon as of excellent quality and most suitable for citrus and other irrigated crops. The scheme embraces a furrow about three miles in length, a weir, and several flumes for taking the canal across dongas. The work is making good progress, and it is hoped to complete it this dry season.

The water court has been very busy of late investigating applications for the use of water in Matabeleland and other parts of the country. About twenty-five cases have been adjudicated upon to date, and there remain a further fifty cases to be dealt with before the close of the session.

The development of underground water supplies in the native reserves is proceeding apace, and the irrigation branch, on behalf of the Native Department, is sinking wells and boreholes in the Gwaai, Semokwe and Gwanda reserves. A Star percussion drill plant has recently been purchased from the Union Government, so that there are now two drill plants at work in the reserves. Further parties are at work sinking wells, erecting pumps, windmills and reinforced concrete storage tanks, and drinking troughs. All this development work is very badly needed to make settlement possible in those reserves situated in the more arid parts of the country.

Second Southern Rhodesia Egg-Laying Test.

This test, which was concluded on 2nd March, 1922, covered a period of 48 weeks. There were 20 pens of five birds in each. The test was divided into two sections, viz., the heavy breed section and the light breed, consisting of seven pens of heavy breeds and 13 of light.

In the heavy breed section the first place was gained by a pen of Rhode Island Reds, owned by Mr. C. L. Brown, of Salisbury, which

put up a good record of 864 eggs, 835 of these being 2 oz. and over, and their total weight 115 lbs. 4 7-16 oz. One bird laid 199 eggs all 2 oz. and over; three others between them laid only five eggs under 2 oz., while one laid 21.

In the light breed section the first place was gained by a pen of White Leghorns, owned by Mr. A. V. Coch, of the Weymouth Poultry Farm, Bulawayo. The total number of eggs laid by this pen was 1,120, an average of 224 per bird for the 48 weeks. Those weighing 2 oz. and over totalled 974, and their weight totalled 126 lbs. 8 5-16 oz. Two birds laid respectively 240 and 238 eggs, which is a good record.

The second pen, owned by Mr. C. L. Brown, in the light breed section, ran the first very closely, there being a difference only of seven eggs, weighing 2 oz. and over, between the two, and a difference of 7 11-16 oz. in the total weight of these.

Although some of the totals of individual pens were greater in the previous test, there were better results from each pen as a whole in this test. This is satisfactory, showing as it does a general improvement in quality.

Further comparing the total number of eggs on the two tests, and basing each on a period of 48 weeks, the second test shows an improvement of over 1,000 eggs, and when we take into consideration the fact that on the 1921-1922 test there were seven pens of heavy breeds and a number of birds at various periods lost time when broody, whereas in the 1920-1921 test there were no heavy breeds, a still greater improvement is shown. This test compares very favourably indeed with those in the Union and other countries, and especially so considering that the poultry industry in this country is in its infancy, and that this is only the second laying test held here.

Although there were several deaths, the majority due to unavoidable causes, the health of the birds was excellent throughout. The monthly output of eggs was very constant during the period, proving that it is quite possible to produce a uniform output the year round, and that therefore there should be no period when eggs are scarce, given proper feeding, care and treatment.

The condition of some of the birds on arrival left something to be desired, and these had to be watched and brought into good laying condition, a hint that should be taken by those who intend to enter birds for future tests.

The feeding on this test was the same as that on the 1920-1921, as it was found that it could not be improved upon for egg output and health of the birds.

The houses and pens are in excellent condition; the pisé a terre of which the houses are constructed has stood the wear of over two years in a remarkable manner.



Winning pen, light breed section, second egg-laying test. Owner, Mr. A. V. Cock,
Weymouth Poultry Farm, Bulawayo.

Southern Rhodesia Veterinary Report.

April, 1922.

AFRICAN COAST FEVER.

No cases occurred during the month.

QUARTER-EVIL.

The following mortality in cattle was reported:—Salisbury 4, Makoni 20, Umtali 24, Melsetter 7 (also 2 sheep), Hartley 8, Gwelo 1, Umvuma 7, Selukwe 6, Enkeldoorn 15, Inyati 14, Bulawayo 3, Plumtree 30, Umzingwane 9, Matobo 19, Belingwe 17, Gwanda 10, Victoria 34.

CONTAGIOUS ABORTION IN CATTLE.

One centre of infection was found in the Salisbury district.

MYIASIS (SCREW WORM) OF CATTLE.

A few cases reported from Bulawayo and Plumtree districts.

SWEATING SICKNESS OF CALVES.

The following cases were reported:—Salisbury 1, Bulawayo 1, Plumtree 2.

HORSE-SICKNESS.

The following mortality was reported:—Salisbury 1, Enkeldoorn 1, Nyamandhlovu 1, Insiza 1, Inyati 1, Matobo 1, Gwanda 2.

TRYPANOSOMIASIS.

In the Hartley district 16 oxen, which had made several trips to Robb's drift, on the Umniati River, were found to be infected. In the Gwelo district a somewhat heavy mortality occurred amongst the cattle on the Inyoka Estate, which is about 30 miles from the nearest known tsetse fly area.

TUBERCULOSIS.

At the Shangani Estate the pedigree Shorthorn herd was submitted to a further testing with tuberculin, with the result that 22 animals re-acted.

JOHNE'S DISEASE.

It is only quite recently that this disease has been demonstrated in Southern Rhodesia, and the following short description is published for the information of stockowners.

The disease is insidious in its onset and slow in its progress; months, even years, may elapse before it becomes evident. There is a gradual emaciation, periodically appearing but persistent diarrhoea, evil-smelling, watery-like faeces mixed with gas bubbles and mucous flakes are passed without straining. Apart from this, the general condition of the animal is only slightly disturbed; the appetite is usually maintained, although increased thirst is evident. As the disease progresses, emaciation and anaemia become more pronounced, death finally resulting from extreme emaciation.

Post Mortem.—Extreme emaciation is evident. Both small and large bowels may be involved, there is marked thickening of the bowel wall, and when cut open the lining membrane shows the characteristic coarse wrinkling which cannot be removed by gentle friction. Further, numerous pin point-like hæmorrhages are seen on the coats of the corrugations. The associated lymphatic glands are enlarged.

Prevention.—Medicinal treatment is useless. Isolation and destruction of affected animals as soon as possible after recognition of the disease, thorough disinfection of the stables and raising young cattle on new and uninfected pastures are, in the present state of our knowledge, all that can be recommended.

IMPORTATIONS.

From Union of South Africa:—Bulls 13, heifers 13, horses 111, mules 20, donkeys 24, sheep 1,763, goats 677.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 1,499, breeding cattle via Liebig's Drift 120, mules 2, pigs 207. To Congo:—Mules 12, pigs 44, cattle 42. To Northern Rhodesia:—Sheep 65, pigs 1. To Portuguese East Africa:—Bulls 8, slaughter oxen 25, cows 95, heifers 24, calves 25, pigs 65.

May, 1922.

AFRICAN COAST FEVER.

MELSETTER DISTRICT.—Early in the month a cow died on the farm Randfontein, and on *post-mortem* examination the owner found lesions suspicious of Coast Fever, the existence of which was subsequently confirmed by microscopic examination. On careful examination and temperaturing of the herd, three animals were found affected and were destroyed.

On 15th May the District Veterinary Surgeon received information that cattle were dying on the farm Merino in the southern section of the district. On inspection it was found that 14 animals had died and several were obviously sick. Coast Fever was diagnosed and subsequently confirmed by microscopic examinations. On the 26th the disease

was discovered on the adjoining farm Bamboo Creek. In both cases the infected herds were moved to a temperature camp on clean veld. The mortality at Merino was 27 head and at Bamboo Creek 44 head.

CHARTER AND CHILIMANZI.—After nearly twenty years' freedom from Coast Fever, a serious outbreak occurred in the Charter district on the Wiltshire Estate, and on investigation further centres of infection were found on the farm Swartfontein, adjoining the Enkeldoorn commonage, and on the farm Mooifontein, ten miles west of Umvuma, in the Chilimanzi district. The infection was carried from the Wiltshire to Swartfontein by transport oxen, and from Swartfontein to Mooifontein by some of the same animals.

So far there is no clue as to the origin of the infection. Early in 1921 cattle were purchased in the Plumtree district and removed to the Wiltshire Estate by rail to Umvuma. The farms on which these cattle were purchased and the roads by which they travelled to the railway have never been infected with Coast Fever. Some infection did exist at that time in the adjoining district of Matobo, but if these cattle brought the disease with them, it is strange that there has been no evidence of its existence so far on the farms whence they came or on farms *en route* to the railway.

At the Wiltshire Estate there are about 4,000 head of cattle involved, and fortunately all are in well-fenced paddocks.

The mortality during the month was as follows.—Wiltshire 380, Swartfontein 15, Mooifontein 1.

Police cordons have been placed around all the infected areas, and three day dipping of the infected herds is carried out under the supervision of cattle inspectors. Arrangements are being made to move a large number of the Wiltshire cattle to clean veld.

QUARTER-EVIL.

The following mortality in cattle was reported.—Marandellas 4, Umtali 25, Melssetter 17, Selukwe 4, Shabani 4, Enkeldoorn 12, Umvuma 1, Victoria 6, Umzingwane 2, Matobo 7, Plumtree 69, Nyamandhlovu 2, Inyati 5, Insiza 14, Belingwe 31, Gwanda 9, Hartley 4.

CONTAGIOUS ABORTION IN CATTLE.

Fresh centres of infection were found in the Mazoe, Mrewa, Goromonzi and Makoni districts.

HORSE-SICKNESS.

The following mortality was reported:—Sinoia 1. Urungwe 1, Wankie 1, Insiza 1, Bulawayo 3, Hartley 1.

IMPORTATIONS.

From Union of South Africa:—Bulls 166, heifers 11, horses 165, mules 48, donkeys 24, sheep 1,941, goats 640.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 1,503, horses 1, mules 2, pigs 248. To Congo:—Donkeys 16, pigs 45, cattle 10. To Northern Rhodesia:—Horses 17, pigs 46, sheep 275. To Portuguese East Africa:—Cows 2, calves 2.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

Agricultural Outlook.

Farmers are busy shelling their maize and selecting seed for next season's sowing. Reports go to show that relatively the best crops of maize will be in the Shamva, Bindura and Concession areas. The drought was felt particularly severely in the Glendale, Passaford and Selby areas, and the yields there are said to be very short. In the Lomagundi district the rainfall was very scanty, and considerably less than half a crop is anticipated over the whole of the district. Speaking generally, the quality of the maize is good, although, of course, not equal to last year's, and there is a greater proportion of light and chaffy grain. It is pleasing to note that the sacks which have so far reached the sidings are of good quality and better sewn than is usually the case. The severity of the drought can be gauged by the fact that the mean rainfall over the whole of the Territory was only 16.80 ins., compared with a normal mean of 28.10 ins. In view of the fact that a few inches only fell during the months from January onwards, it is indeed surprising that the maize crop, and indeed all other crops, this year are as great as they are. Among the fodder crops grown, the velvet bean stands out pre-eminently as a drought resister, the experience of the past season demonstrating this fact beyond any doubt. It has proved invaluable for dry fodder and silage, and many farmers have decided to grow it on a much larger scale in future. There is a big demand for velvet bean seed, and those farmers who have any for sale can readily dispose of it. The Tepary bean is increasing in popularity, and several farmers report that they have obtained better crops from this variety than from any other edible bean which they have previously grown. There has been a strong demand for sunflower seeds and ground nuts in Salisbury, and we understand the Farmers' Co-op., Ltd., have sold all supplies sent to them.

A number of farmers are fattening bullocks by stall feeding. The utilisation of the products of the farm in this way, and the provision for rotation which it ensures, is likely to prove remunerative. There is an improved demand for prime slaughter stock, and this demand will probably be keener in the next few months.

Despite the trying conditions, stock are faring remarkably well, and we have heard so far of very few deaths from poverty. The ensuing months before the rains set in will, of course, be the most difficult period of the year, and it is too much to hope that losses will not occur. The Rhodesian veld, however, possesses remarkable properties, and it is surprising how cattle exist where grass is scarce if only water is within easy reach. There has been considerable movement of stock from drought areas to districts more favourably situated, and the concessions granted in such cases by the Railway administration are much appreciated. The outbreaks of East Coast Fever, to which we refer in an editorial notice, have caused some disquietude in the country, but there is reason for believing that the measures taken will confine the disease to its present limits. Grass fires, so far, have been exceptionally few, due undoubtedly to the precautionary measures initiated by farmers and the Native Commissioners. Hopes are expressed for early rains, which we trust will be fulfilled. Really bad seasons in Southern Rhodesia are fortunately few and far between; when they do occur, however, they teach invaluable lessons, and it is freely admitted that the past season has demonstrated the advantages of good and scientific methods of husbandry. We hope, nevertheless, that the past season will stand as an exception as regards rainfall for many years to come.

A Mealie Store.

A correspondent sends us the following note, which may be of use to some of our readers:—

"I saw a simple and effective way of storing mealies on my neighbour's farm and have copied it, as have others: A square brick building, with a granite floor and a trap door at the top of one wall for pouring in the mealies; a hole about 2 ft. long by 1 ft. high at the bottom of one wall leading into a trough, with a hinged door on top of it which can be locked (8 ft. 6 ins. square and 7 ft. high holds about 120 bags).

"No doubt there are many more effective stores for mealies, but this is as cheap and effective as could be required."

Review.

"SURVEYING FOR SETTLERS."

This small book, which is well printed on stout paper, has been written by Mr. William Crosley, M.Inst.C.E., and is published at 7s. 6d. by Messrs. Crosby, Lockwood and Son. The author is careful to state that it is intended principally for the use of pioneers, farmers, planters and others in new countries, in order to assist them to carry out minor surveying operations and to afford a general guide to many of the small engineering problems with which the new settler is frequently faced.

The first four chapters, embracing rather more than half the book, deal with the measurement of flat areas of uniform or irregular shapes, the measurement of horizontal distances, the plotting of plans and computation of areas. Simple forms of instruments for taking angular measurements are briefly described, and the relations between dimensions and angles are clearly set out together with traverse tables. The measurements of heights and the use of the dumpy level for levelling are explained with sufficient clearness and detail to enable the average individual to perform such operations as taking levels for water furrows, etc.

The remaining chapters, V. and VI., deal generally with the measurement and use of water for irrigation and power purposes, and also contain considerable data regarding water and its properties. The construction of dams and hints on roadmaking are also briefly touched upon. An appendix gives certain notes on the Rhodesian climate, as evidently the author had in mind the utility of this book for the new settler in this country. There are nearly fifty illustrations and plates, and the text being set out in paragraphs, affords easy reference to any desired item.

The book serves admirably the purpose for which it is written, and we commend it to the notice of settlers in this country.

A. C. J.

Contagious Abortion Vaccine.

It is hereby notified that from date hereof the price of contagious abortion vaccine prepared at the Veterinary Laboratory, Salisbury, will be sixpence (6d.) per dose.

RHODESIAN MILK RECORDS.

Name of cow.	Breed.	Commenced record.	Milk in lbs. Latest return.	Butter fat in lbs. Latest return.	Milk in lbs. to date.	Butter fat in lbs. to date.	Number of returns to date.	Name and address of owner.
Brakfontein Aggie ...	Friesland	1/2/22	840	...	3,871.75	...	4	Renniker & Rettie, Salisbury.
Bossie ...	do	30/8/21	780.5	...	3,790	...	5	J. H. Parker, Vaillima Dairy, Ryo.
Gippy ...	do	22/8/21	770	...	3,952.75	...	5	do
Kitt ...	do	do	735	...	4,273.5	...	6	do
Nanny ...	do	3/9/21	836.5	...	3,888.5	...	5	do
Daisy ...	Shorthorn	2/11/21	215.6	8 37	2,570.4	106.08	8	C. G. T. Cooper, Essexvale.
N'Genga ...	do	30/11/21	301.7	21.63	2,510.2	123.64	7	do
Pepper ...	do	do	220.5	11.02	2,021.2	96.64	7	do
Ann ...	do	15/2/22	301	13.23	1,524.6	67.61	4	do
Rosebud ...	Friesland	9/10/21	338	20.28	3,857	187.57	7	J. S. Struthers, Palm Tree, Sinoia.
Granny ...	do	do	331	17.87	3,497	152.56	7	do
Maureen ...	do	do	273	11.46	3,231	191.39	7	do
Cherry Blossom ...	do	16/10/21	321	17.29	4,037	202.42	7	do
Bell ...	do	20/11/21	822	36.16	7,701	286.56	7	do
Snowflake ...	do	22/1/22	461	15.67	3,211	114.34	5	do
Lady ...	do	4/2/22	486	19.92	2,925	121.75	4	do
Corral ...	do	19/2/22	854	51.24	3,535	179.16	3	do
Pansy IV ...	do	6/5/22	873	...	1,832	...	2	C. F. Anthony, Randolph Farm, (twelo
Ringte Hilda ...	do	1/4/22	400	...	400	...	1	do
Ringte Bella ...	do	do	450	...	450	...	1	do
Ringte ...	do	1/1/22	250	...	1,480	...	4	do
Seponika ...	do	8/10/21	434	...	1,948.5	...	4	G. W. Davis, N'Gombe, Sinoia.
Quettie ...	do	do	514.5	...	5,126	...	7	do

RHODESIAN MILK RECORDS—continued.

Name of cow.	Breed.	Commenced record.	Milk in lbs. Latest return.	Butter fat in lbs. Latest return.	Milk in lbs. to date.	Butter fat in lbs. to date.	Number of returns to date.	Name and address of owner.
Spotie*	Shorthorn	22/7/22	136.5	...	1,653.5	...	9	R. C. MacLagan, Chitora, Rusape.
Henrietta*	do	2/9/21	237	...	1,949	...	8	do do
Agnes*	do	9/9/21	175	...	1,438.5	...	7	do do
Cowslip*	Ayrshire	14/10/21	210	...	1,102.5	...	5	do do
Elaine*	Shorthorn	do	182	...	822.5	...	5	do do
Roan Beauty*	do	23/11/21	185.5	...	868	...	5	do do
Moreen*	Friesland	21/12/21	343	...	2,568.5	...	5	F. E. Pickering, Fairview, Sinoia.
Doreen*	do	do	322	...	2,510.5	...	5	do do
Peach*	do	do	304	...	2,337.5	...	5	do do
Umcola*	do	do	273	...	2,299	...	5	do do

* These cows are suckling their calves.

Farming Calendar.

August.

BEE KEEPING.

Now that warmer weather prevails, hives can be opened with safety and examined. Do this when the sun is shining and without exposing the bees too long. The queens are now laying, and, should there be a scarcity of food, feed the bees with syrup inside the hive. Where a hive carries a fair supply of honey, queens can also be encouraged to produce eggs by crushing with a knife blade the cappings of sealed honey still remaining in brood combs. This month and next bees will be collecting nectar and pollen from fruit and bush bloom. Where strong south-easterly winds prevail, hive entrances should be shielded. This will afford bees great assistance in their going out and coming in.

CITRUS FRUITS.

Orange trees should already have been pruned, and should now be ready for the first irrigation. The first growth should be commencing early in the month, and by this time the trees should already have had one good soaking. As soon as the trees have set their fruit they should never be allowed to stop growing through lack of moisture, otherwise the fruit is liable to be poor in quantity and lacking in quality. After irrigation, cultivation should follow, and the earth round the trees be loosened with a spade. If fertiliser is to be used, it should be applied after the first irrigation, so as to be thoroughly incorporated with the soil in the cultivation following.

CROPS.

Provided there are no heavy frosts, dhal may be allowed to remain until August before harvesting. As a second or third year crop, dhal can always be cut earlier, say towards the end of June or July. Ploughing should be undertaken continuously wherever possible; the value of early ploughing cannot be over-estimated. Except on light sandy soils, ploughing should be followed as soon as possible by harrowing. Mangels can be pulled out and fed as required. The ensilage pit can be opened and the contents fed. Seed potatoes should be worked over and decayed tubers removed.

In cereals under irrigation care should be taken to weed out any Drabok or Darnel (*Lolium temulentum*) that may be growing among the crop, as the presence of this weed is injurious. Care should be taken not to over-irrigate any of the lands. Early crops of potatoes under irrigation or on vlel soils will be planted this month.

DAIRYING.

This is one of the slackest months in the year. Cows should be getting a full ration of ensilage or other succulent food preparatory to calving down in September or October; this will enable them to pick up rapidly and start producing milk in quantity without any leeway to be made up. Butter is easily made during this month, but on cold mornings the cream should be warmed slightly to bring it to a temperature of from 62 to 64 degrees. If this is not done, churning is prolonged over an indefinite period, varying with the breed of the cow. If cheese is being stored, the store room

should be kept moist by allowing a bath of water to stand there, or by hanging up wet sacking or sheets in the room. The dairy should be whitewashed, and the shelves scrubbed with hot water containing a little formalin or permanganate of potash preparatory to the coming season.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillars. The crops should be sprayed immediately with an arsenical wash.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by webworm. Do not spray plants of which the foliage is to be eaten within three weeks of use.

Onion.—May still be troubled with thrip. Use tobacco wash or paraffin emulsion.

Deciduous Fruits.—Any trees infested with scale may be sprayed with a winter wash during August. Lime sulphur salt wash or scaleside is recommended.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

FORESTRY.

Cuttings of ornamental shrubs, roses, etc., struck in sand last month should be transplanted into good soil as soon as they shew a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fireguards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

Very little hatching should be carried out after the end of this month. Such chicks as are hatched during September will require very special care to bring them along without set-backs. Far too many chicks in this country are hatched too late, with the result that they develop slowly, are stunted, and never make good, profitable stock.

The pullets hatched in April should soon be coming on to lay, and should be in the quarters in which it is intended to keep them during their first year of laying. All when four and a half to five months old should be drafted to these quarters and not moved; if they are moved after they have started laying, they will stop and go into a partial moult.

The early hatched cockerels; that is, all except the very best, should by this time have been killed or marketed for killing purposes; it does not pay to keep them a moment longer than necessary. Needless to say, all pullets and cockerels should have been run in separate sections as soon

as the sex can be distinguished; to do so ensures better and more profitable birds. Before putting the pullets into their new quarters, these should be thoroughly cleaned and disinfected. With the advent of warmer weather, a more strenuous war should be waged on insects. Disinfection and spraying of the houses and runs cannot be too thorough or constant; failure to carry this out is responsible to a very large degree for poor quality birds and a low production of eggs.

Special attention should be given to young turkeys, in order to bring them along quickly for the Christmas sales, and so reap a larger profit; after this period the demand for some time is as a rule poor.

Ducks too require special attention to keep them laying; without good, dry, warm sleeping quarters they will not produce eggs to any appreciable extent.

Eggs will be dropping in price; those who have large contracts at so much per dozen all the year round will score. Co-operation is urgently required on the part of poultry keepers in this respect.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On diorite farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. The bulls may again be put back into the herds. Any very young calves should be kept near home, and dipping should be carefully attended to. In dairy herds on any soil whatever, feeding, housing and bedding cannot be relaxed. Cows in full milk will benefit by a ration of, say, 5 lbs. of maize (crushed and soaked), 30 lbs. to 40 lbs. of ensilage or pumpkin and 8 or 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of peanuts, crushed with the shell, or linseed ground with maize, or peanut cake, a very great benefit will be derived. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. It will pay to feed to them a little sweet hay, bean meal, linseed, peanuts or peanut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year, but on very dry veld a handful of mealies and a little hay or ensilage will materially assist ewes with young lambs.

VEGETABLE GARDEN.

Plant out asparagus, cabbage, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

VETERINARY.

Redwater and gallsickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

September.

BEE KEEPING.

In sheltered localities many trees in the bush will now be in bloom. Should there be indications of swarming, put on a crate of sections or shallow frames, correctly fitted with super-foundation. Where a swarm has been secured, place it in a modern hive, and from an established stock remove a frame of comb containing unsealed brood and honey, shake off the adhering bees on to their own alighting board, then insert this comb into the centre of the newly hived swarm. This plan compels the bees to start work at once. As a means of preventing the escape of the queen, a narrow strip of excluder zinc may be fastened at the entrance. This should be removed after about two weeks.

CITRUS FRUITS.

If the trees were irrigated early in August, the next application of water should be given about the first or second week of this month. After irrigation, cultivation should follow. Constant attention should be given to young trees, and a watch kept for any adventitious shoots or suckers, which should be cut away at once. This should be attended to right through the growing season.

CROPS.—See August.

ENTOMOLOGICAL.

Tobacco.—Young plants in seed beds may suffer from cutworms. See Bulletin No. 347.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond back moth and webworm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus Trees.—Scale insects commence to increase rapidly with the advent of warmer weather, but the trees should not be sprayed or fumigated while in blossom.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. All gum seeds should be planted now if it is intended to grow the transplants in tins. If they are to be grown in beds only, don't plant gum seeds until next month. The seed beds may with advantage be prepared now and watered to make the weed seeds germinate, so that they may be destroyed before planting next month.

GENERAL.

Indigenous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and

much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

In view of the high prices of poultry foods, every farmer and poultry keeper is advised to grow as much food (grain and green foods) as possible not only for the requirements of his own birds, but also for sale. Don't delay with the sowing and planting of such foods. One of the most useful and economical poultry foods is the sunflower; the small black is the best. Mealies, wheat, buckwheat, linseed, monkey nuts, beans and peas are all excellent poultry foods to grow. Among the best green foods to grow are sunflower leaves, dhal, lucerne, ground nut leaves, kudzu vine, sweet potatoes, Swiss chard, Chinese cabbage, etc.

During this month all houses and pens should be thoroughly overhauled and disinfected. The houses should be made absolutely watertight in view of the coming rainy season. A damp house is most conducive to illness and a less number of eggs.

All breeding pens should be broken up during the month, the breeding birds put on free range for six weeks or so, and then brought into laying houses. The male birds should be gone over carefully, and all without exception which show signs of lack of vigour, or which will be too old next year, eaten or sold for killing. Only the very best should be retained for next season's breeding and mated to the best of their daughters.

Shade should be provided for the younger chicks. A few small grass shelters will suffice if there is no natural shade. See that the drinking water is in the shade. Give the later hatched chicks as much food as they will eat. Chopped onions or preferably green onion tops will act as a good tonic and improve their appetites.

Young ducklings must be kept out of the sun. This is fatal to them, as they are very subject to sunstroke.

Keep a good lookout for insects either on the adult or young stock and in the houses, and if found, eliminate at once. No chick, duckling or young turkey can possibly thrive if they are irritated by these, and adult birds will not lay well.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary, and seeing that they do not get too poor. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance.

Sheep.—The remarks for August apply. If spring lambs are expected, it will be wise to see that the sheep shed is in good order—clean, dry, properly drained and airy. Watch that the ewes shall not be poor when they lamb, and remember that they cannot rear good lambs if the veld is bad, but must have their grazing supplemented, just as milk cows are fed in order to produce milk.

TOBACCO.

Begin sowing seed beds each fortnight for the acreage proposed to be planted; fertilise and stimulate growth so as to be ready for planting out should rain come early in November.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip may be made now.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shews slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

Farmers' Income Tax Returns.

We hope to publish in our October issue an article which sets out in detail the method to be followed in the filling in of these returns. The article will, however, be available in bulletin form from 1st September, and farmers who wish to obtain a copy should apply to the Commissioner of Taxes, Income Tax Department, P.O. Box 801, Bulawayo, or the Director of Agriculture, Salisbury.

Southern Rhodesia Weather Bureau.

MAY AND JUNE, 1922

Pressure.—During the month of May the mean barometric pressure was slightly above normal (0.01 in.) in the southern portion of the country, and below normal (0.02 in.) in the central and northern portions of the country. The fluctuations in the barometric pressure during the month were large, the maximum range amounting to 0.30 in. at Bulawayo and 0.26 in. at Salisbury.

High pressure areas were present from the 3rd to 9th and 20th to 29th, the maximum high on the 3rd being 0.15 above normal at Bulawayo and 0.10 above normal at Salisbury.

A low pressure area was present from the 10th to 19th, the maximum low on the 15th being 0.16 below normal at Salisbury and 0.15 below normal at Bulawayo.

During the month of June the barometric pressure was below normal over the whole country, varying from 0.01 in. below normal at Bulawayo to 0.04 in. below normal at Salisbury.

The maximum range in the fluctuations amounted to 0.21 in. at Bulawayo and 0.14 in. at Salisbury.

High pressure areas were present from 8th to 11th, 22nd to 24th, and 28th to 30th, the maximum high on the 29th being 0.12 above normal at Bulawayo and 0.05 above normal at Salisbury.

Low pressure areas were present from 1st to 7th, 12th to 21st, and 25th to 27th, the minimum low on the 26th being 0.09 below normal at both Salisbury and Bulawayo.

Temperature.—During May the mean temperature was above normal over the bulk of the country, and varied from 0.6° below normal at Umtali to 1.8° above normal at Salisbury. The mean daily temperatures varied from 2.7° below normal at Umtali to 1.9° above normal at Salisbury, whilst the mean night temperatures varied from 0.8° above normal at Bulawayo to 1.9° above normal at Salisbury.

During June the mean temperature was above normal over the whole country, and varied from 1.6° above normal at Salisbury to 4.5° above normal at Gwelo.

The mean daily temperatures varied from 0.2° above normal at Umtali to 5.0° above normal at Gwelo, whilst the mean night temperatures varied from 0.3° above normal at Salisbury to 4.1° above normal at Gwelo.

Rainfall.—During the first week in May rain was general over the whole country, the maximum precipitation being in the southern and eastern portions of the country, the average fall in Zone B being 1.24 ins., with a maximum in Bulalima district of over 2 ins.

The following was the mean fall during May in the various zones compared to normal:—

	Inches.	Normal. Inches.
Zone A	0.48	0.28
Zone B	1.24	0.40
Zone C	0.15	0.48
Zone D	0.58	0.50
Zone E	0.47	0.45
Zone F	1.37	1.60

Seasonal Rainfall.—The present report concludes the current meteorological season, and the following general summary will therefore be of some interest.

The mean rainfall over the whole country during the season has only been 16.80 ins. as compared with a normal of 28.10 ins., a shortage of 40.2 per cent., which occurred during the period January to March. The shortage was general in all the zones, and varied as follows:—

	Deviation from normal. Inches.	Percentage deviation from normal.
Zone A (Western Matabeleland)	— 7.40	— 31.2
Zone B (Eastern Matabeleland)	— 9.70	— 43.9
Zone C (Western Mashonaland)	— 10.90	— 37.1
Zone D (North-Eastern Mashonaland)	— 16.50	— 47.7
Zone E (South-Eastern Mashonaland)	— 15.30	— 45.1
Zone F (Eastern Border)	— 31.60	— 53.8

As regards individual districts, the following were the extremes in the various areas:—

	Deviation from normal. Inches.		Deviation from normal. Inches.
Zone A—			
Wankie	— 1.40	S. W. Gwelo	— 11.30
Zone B—			
Belingwe	— 8.10	Matobo	— 11.38
Zone C—			
Chilimanzi	— 6.70	Lomagundi	— 13.57
Zone D—			
Darwin	— 9.26	Makoni	— 17.47
Zone E—			
Charter	— 8.34	Melsetter	— 23.97

RAINFALL.

STATION.	1922.		Total for year ended June 30, 1922.	Normal rainfall to end of period.
	May.	June.		
ZONE A. :				
Bubi—				
Imbosu Kraal	64	04	18.31	24.05
Inyati	42	—	14.35	23.88
Bulalima—				
Kalaka	28	—	11.60	22.16
Riverbank	1.19	02	15.18	23.28
Bulawayo—				
Fairview Farm ... ..	...	...	...	22.61
Keendale	70	—	14.69	20.88
Lower Rangemore	92	10	14.04	23.78
Observatory	89	—	15.35	23.60
Paddy's Valley	43	—	17.95	23.40
Gwelo—				
Dawn	26	02	13.50	26.47
Somerset Estate	23	—	14.95	24.59
Wankie—				
Waterford	17	—	22.17	23.56
ZONE B. :				
Belingwe—				
Bickwell	73	—	17.58	21.24
Bubje Ranch	93	—	8.40	20.94
Bulalima—				
Garth	2.09	—	12.57	25.60
Retreat	1.85	—	14.79	20.82
Tjankwa (Syringa)	1.87	—	11.22	23.75
Tjompanie	2.41	01	17.71	24.01
Gwanda—				
Gwanda Gaol	1.48	02	11.63	20.44
Mtshabezi Mission	1.61	—	10.58	22.62
Tuli	1.17	08	10.65	14.69
Insiza—				
Albany	—	—	13.66	20.87
Filabusi	86	—	12.33	21.33
Fort Rixon	—	—	12.42	21.69
Infiningwe	96	02	10.95	25.63
Inyezi	90	—	15.12	21.41
Matobo—				
Holly's Hope	1.58	—	10.53	22.27
Rhodes Matopo Park	1.15	—	12.12	23.12
Umzingwane—				
Essexvale	1.26	—	12.09	23.94
ZONE C. :				
Charter—				
Bushy Park	—	—	15.24	26.44
Enkeldoorn	27	—	22.30	29.18
Marshbrook	17	—	19.78	29.32
Range	21	—	20.07	31.29
Umniati	—	—	13.16	23.50
Vrede	—	—	14.38	28.87

RAINFALL (*Continued*).

STATION.	1922.		Total for year ended June 30, 1922.	Normal rainfall to end of period.
	May.	June.		
ZONE C.—(Continued)				
Chilimanzi—				
Wylde Grove	·03	—	19·05	25·75
Gwelo—				
Cross Roads	·08	—	16·19	25·22
Globe and Phoenix Mine	·10	—	18·27	29·04
Rhodesdale Ranch	·07	—	15·08	26·25
Woodenhove	·14	—	15·27	28·89
Gwelo (Gaol)	·22	—	15·00	26·25
Hartley—				
Ardgowan	·10	—	26·75	31·02
Beatrice... ..	·18	—	21·03	28·82
Carnock	·18	·03	17·11	31·49
Philiphaugh	·27	—	22·20	31·59
Cromdale	—	—	17·81	...
Elvington	·06	—	17·27	31·44
Gatooma	·25	—	20·95	31·48
Gowerlands	·08	—	17·35	30·21
Hallingbury	·08	—	18·41	28·24
Hartley (Gaol)	0·25	—	20·95	32·48
Jenkinstown	—	—	20·88	29·73
Nyagordi	·11	—	18·85	30·03
Ranwick	—	—	20·71	28·15
Spitzkop	·22	—	17·67	28·74
Lomagundi—				
Argyle	·46	—	21·76	33·29
Darwendale	—	·06	18·54	31·15
Gambuli	·30	—	22·39	37·76
Lone Cow Estate	—	—	22·40	34·10
Maningwa ... ..	...	...	...	...
Mrindagomo	14	—	18·18	...
Mukwe River Ranch	—	—	20·81	31·34
Palm Tree Farm	·25	—	21·79	32·68
Sinoia	·63	—	25·47	31·51
Sipolilo	·94	—	24·88	32·67
Talfourd	·16	—	18·17	33·71
Salisbury—				
Avondale	·42	—	21·55	32·24
Botanical Experiment Station...	·27	—	17·17	33·41
Bromley	·44	—	19·29	34·36
Cleveland Dam	·17	—	20·21	30·80
Gwebi	·47	—	17·67	34·46
Hillside	·63	·02	18·81	30·57
Lilfordia	·31	—	18·44	30·27
Salisbury Gaol	·90	·01	17·79	32·13
Sebastopol	—	—	18·31	32·62
Stapleford	—	—	19·87	33·90
Tisbury	·95	·03	20·69	32·15
Vainona	·18	—	18·46	34·15
Sebungwe—				
Sikombela	—	—	16·57	28·61

RAINFALL—(Continued).

STATION			1922.		Total for year ended June 30, 1922.	Normal rainfall to end of period.	
			May.	June.			
ZONE D. :							
Darwin—							
	Mount Darwin	...	...	27	—	22·10	31·36
Inyanga—							
	Inyanga	...	...	...	—	...	37·39
	Rhodes Estate	..	...	52	—	20·08	36·59
Makoni—							
	Eagle's Nest	...	...	1·22	—	16·34	33·19
	Wensleydale	...	...	35	—	14·37	32·48
Mazoe—							
	Benridge	...	..	51	—	18·59	34·96
	Bindura	...	...	1·18	—	20·16	35·55
	Ceres ...	...	...	83	30	22·77	38·82
	Citrus Estate	..	..	—	05	18·53	32·62
	Craigengower	...	...	17	—	23·44	36·09
	Kilmer	...	...	—	—	20·97	35·91
	Kingston	...	...	1·45	—	26·47	37·58
	Mazoe	...	...	11	—	23·54	29·98
	Mazoe Dam (centre)	...	...	38	—	20·87	33·00
	Omeath	...	...	53	02	18·42	32·42
	Ruia	...	...	1·14	—	21·40	39·51
	Ruoko Ranch	...	...	58	—	26·87	33·54
	Rustington	...	...	...	—	...	32·72
	Shamva	...	...	1·12	—	22·60	34·99
	Stanley Kop	...	...	1·28	03	20·71	31·28
	Sunnyside	...	...	...	—	...	34·59
	Teign	...	...	40	—	25·07	36·19
	Virginia	...	...	14	—	17·36	31·54
	Zombi	...	...	89	—	29·30	36·80
Mrewa—							
	Glen Somerset	...	..	1·06	—	15·80	35·90
	Mrewa	...	...	1·15	—	20·47	35·46
	Selous Nek	...	...	91	—	18·57	34·93
Mtoko—							
	Makaha	...	...	08	—	14·05	37·88
	Mtoko	...	...	59	—	19·24	29·04
Salisbury—							
	Glenara	...	...	..	—	...	31·62
	Goromonzi	...	...	71	—	22·50	39·07
	Meadows	...	...	28	—	20·55	40·07
ZONE E. :							
Belingwe—							
	Belingwe	...	...	77	—	13·47	28·75
Charter—							
	Buhera	...	...	37	—	21·81	30·15
Chilimanzi—							
	Chilimanzi	...	...	17	—	18·40	27·01
	Driefontein	...	...	16	02	17·05	27·17
	Felixburg	...	...	—	—	19·95	30·60
	Grootfontein	...	...	—	—	18·01	27·59
	Induna Farm	...	...	08	—	23·77	29·11

RAINFALL (*Continued*).

STATION.	1922.		Total for year ended June 30, 1922.	Normal rainfall to end of period.	
	May.	June.			
Zone E.—(Continued)					
Gutu—					
Gutu	14	—	21·49	30·32
M'vimvi Ranch	35	—	13·07	28·72
Tel-el-Kebir	20	—	15·58	29·66
Gwelo—					
Oaklands	—	—	16·67	30·77
Partridge Farm	—	—	21·27	30·07
Sheep Run Farm	23	—	18·03	29·95
Insiza—					
Thornville	46	—	13·88	26·95
Inyanga—					
St. Trias' Hill	78	36	18·75	...
Makoni—					
Chimbi Source (Chitora)	80	10	13·44	35·32
Craigendoran	19	—	15·52	30·94
Forest Hill	37·76
Gorubi Springs	15	10	11·97	38·11
Mona	20	—	18·57	35·05
Monte Cassino	46	—	19·76	35·34
Rusape	26	—	13·86	32·66
Springs	—	...	37·27
Marandellas—					
Bonongwe	16	—	21·05	31·16
Delta	19	—	17·35	36·46
Land Settlement	49	—	17·37	32·94
Lendy Estates	88	—	17·80	34·34
Marandellas	—	—	16·78	36·97
Nelson	—	—	15·70	30·60
Melsetter—					
Brackenbury	1·19	—	28·62	52·17
Melsetter	1·09	—	25·65	46·11
Tom's Hope	55	02	28·03	47·21
Ndanga—					
Bikita	1·32	—	27·38	61·45
Doornfontein	93	—	20·91	34·80
Selukwe—					
Hillingdon	41	—	17·37	31·77
Rio	34	—	18·40	29·14
Umtali—					
Gilmerton	—	—	12·54	31·39
Jerain	22	—	16·23	32·70
Mutambara Mission	09	—	15·83	29·40
Odzani Power Station	31	—	24·37	36·04
Premier Estate	37	12	15·41	29·84
Stapleford	1·26	1·08	49·66	47·71
Umtali (Gaol)	24	06	11·42	31·90
Victoria—					
Cavan	—	—	15·92	27·85
Clipsham	19	—	10·63	29·12
Gokomere	45	—	16·47	26·17
Histonhurst	58	—	12·75	...

RAINFALL—(Continued).

STATION.	1922.		Total for year ended June 30, 1922.	Normal rainfall to end of period.
	May.	June.		
ZONE E.—(Continued)				
Victoria (Continued)—				
Makahori Farm	...	—	...	...
Makorsi River Ranch	... 30	—	13.22	33.61
Morgenster Mission	... 88	—	...	40.99
Riverdene North	... 32	—	14.59	31.16
Silver Oaks	... 27	—	12.53	28.84
Stanmore	... 21	—	14.94	27.54
Summerton	... 35	—	16.03	25.55
Tichidza	... 93	15	17.61	35.55
Victoria	... 16	—	14.07	26.46
ZONE F.:				
Melsetter—				
Chikore	... 70	17	23.39	47.70
Chipinga	... 1.70	18	28.38	48.37
Helvetia	... ..	...	...	60.71
Mount Selinda	... 1.18	26	31.77	68.67
Vermont	... 1.73	—	38.73	66.36
Umtali—				
Hoboken	... 1.40	—	23.77	59.24

— means nil.

... means no return.

Dates of Meetings of Farmers' Associations, Southern Rhodesia

(SUBJECT TO ALTERATION)

Name of Association	Place of Meeting	Secretary	1922			
			August	September	October	
Banket Junction ..	Banket Hotel	Hon. J. S. Parker	5	2	7	
Beauries District ..	Farmers' Hall, Beauries	W. Krienke	31	28	26	
Bindura ..	Bindura ..	G. Askew	12	9	14	
Bromley ..	Bromley ..	C. J. Shirley	3	7	5	
Darwin ..	Arcadia Farm and Mt. Darwin Store alternately	J. W. Goucher	13	19	8	
Eastern Border (South Melssetter)	Farm Havenwood	J. Thaw-Jollie (<i>pro tem</i>)	No	fixed	dates	
Eastern Districts ..	Good Hope School	M. R. Krienke	12	6	14	
Edmore ..	Edmore ..	M. V. Freere	12	9	14	
Faliburg—Gutu ..	Willard Farm	F. W. Brundshaw	23	27	25	
Figtree Branch, R.L. and F.A.	Figtree Hotel	A. S. Will	17	21	19	
Gabazi ..	Hunyani Drift	A. Kealey-Harvey	19	16	21	
Gatooma ..	Speck's Hotel	E. Seale	12	9	14	
Greysone ..	Chippinga	W. Wood	12	9	14	
Harila ..	Various farm houses, Shangani	M. R. Krienke	20	15	23	
Headlands ..	Headlands Hotel, Gwanda	J. C. Edmonstone	20	15	23	
Hunter's Road Farmers and Stockowners	Headlands	J. de L. Ntumbo	15	12	17	
Inezis—Shangani ..	Hunter's Road Siding	R. W. Twilley	19	16	21	
Inyangura ..	Rhodes Inyangura Estate	M. E. Weale	12	9	14	
Lalapandi ..	Inyangura	E. J. Hacking	15	19	17	
Lalapandi ..	Lalapandi	R. H. Everard	21	18	16	
Makete ..	Shangani	J. G. C. G. G. G.	4	1 and 29	18	
Makete ..	Makete	W. L. McLean	18	No	dates	
Makwiro ..	Makwiro	J. G. Monckton	30	27	25	
Makoni North ..	Makoni South Farm	Lionel Dobell	12	9	14	
Marandellas, Northern ..	Marandellas Farmers' Hall	H. Jackson	5	2	7	
Marandellas, Southern ..	Various Farms	F. N. Gibson	6	4	1	
Masonland ..	Commercial Hotel, Salisbury	C. G. Arnold	3	No	dates	
Mazoe Branch, R.L. and F.A.	Various farm houses	Mrs. G. G. G.	9	18	13	
Mazoe Central ..	Glendale	Mrs. Dudley Davis	11	8	13	
Melsetter ..	Melsetter	P. D. Peasey	5	fixed	17	
Melsetter (North) ..	Cronley	J. Harvie	15	No	dates	
Midlands Farmers and Stockowners	Royal Hotel, Gwelo	R. Wodehouse	15	No	17	
Northern Untali ..	Farm Summerfield	M. Panziger	No	fixed	dates	
Norton and District ..	Norton Store	A. Vuloch	4	No	6	
Que Que ..	Que Que	G. Vrench	19	fixed	21	
Rhodesian Landowners and Farmers	Library Buildings, Bulawayo	E. J. Ross	19	28	21	
Selous ..	Various farms	H. S. Hopkins	19	16	21	
Selukwe ..	Selukwe	W. T. Simpson	17	No	dates	
Shamva ..	Shamva	A. Xusson	17	21	19	
Univutwe ..	Various ranches	Mrs. M. A. Bracewell	3	7	5	
Umvuma District and Stockowners	Umvuma Hotel, Untali	M. V. Freere	26	30	28	
Victoria ..	Victoria	W. F. N. Thornton	12	9	14	
Western ..	Plantree Hotel	W. R. Goucher	12	9	14	

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

CATTLE TRANSPORT AREAS.

It is hereby notified that the boundaries of areas within which the movement of cattle in use for draught purposes is permissible have been fixed as described in the subjoined schedule, as provided for by section 9 of Government Notice No. 21 of 1917, as amended by Government Notice No. 602 of 1921.

J. M. SINCLAIR,

Controller of Stock.

Veterinary Department,
6th July, 1922.

No. 36.—HEADLANDS.

An area bounded by the Nyagadzi River, from where it intersects the northern boundary of Fairfield Estate, down this river to its junction with the Ruenya River; thence in a southerly direction up this river to the north-east beacon of Rathcline; thence along the northern and western boundaries of Rathcline and western boundary of Bannockburn North, the southern boundary of Inyati Block and Yorkshire Estate, to a point due north of the north-eastern beacon of Lone Kop; thence southward and westward along the boundaries so as to include farms Lone Kop, Moodieville, Emerald, Highfield, Netzewa, Fisher-ville and Wakefield; thence up the Macheke River to the southern beacon of Monte Cassino; thence along the southern and eastern boun-

daries of that farm, and from its most northerly beacon in a direct line to the south-western beacon of Changwe Ranch No. 1; thence along the northern boundary of the Fairfield Estate to the first named point.

No. 37.—RUSAPE-INYANGA.

From the junction of the Macheke and Rusawi Rivers; thence an area bounded by and including the following reserves and farms:—Chiduku Reserve, Mount Tikwiri, Zimati, Manda, Windsorton, Nyamasanga, Reserve, Mount Zonga, Makoni Reserve; thence from the eastern beacon of the latter reserve, including Reserve in an easterly and northerly direction, along the boundary of the Inyanga native district to the Ruenya River; thence in a southerly direction up this river to the north-east beacon of Rathcline; thence along the northern and western boundaries of Rathcline and western boundary of Bannockburn North, the southern boundaries of Inyati Block and Yorkshire Estate to a point due north of the north-east beacon of Lone Kop; thence in a direct line along the eastern boundaries of Lone Kop, Moodieville, Emerald and Highfield, the southern boundaries of Highfield, Netzewa, Fisherville, Wakefield, Mere, Cave and Delta, the eastern boundaries of Somers Lust, Elandslaagte, Nyakurwi, Tweedjan and Chiswana.

No. 38.—ODZI.

A point starting from the junction of the Rusawi and Macheke Rivers, down the latter to the Sabi River; thence down this river to its junction with the Odzi River; thence up this river in a northerly direction to the point where it is crossed by the southern boundary of the Makoni Reserve; thence in a westerly direction, including the following farms:—Osborne, Amberwell, Buffalo Bush, Ruiati, Quagga Kloofs, The Pass, Reserve, Zonga, Marngu, Burnt Kraal, Reserve, Tiny, Cotleigh and Charlton; thence in a south-eastern direction along the boundary of the Chiduku Reserve to the point started from.

No. 39.—UMTALI.

(Cancelling area No. 33, dated 20th January, 1922.)

The Umtali native district, excluding those portions lying west of the Odzi River and south of the Wengesi River.

DISTRIBUTION OF SEED FOR CO-OPERATIVE EXPERIMENTS.

It is anticipated that seed of the following summer crops will be available for free distribution under the usual terms of co-operative experiments from 1st August until 31st October. After the latter date no further applications for seed of summer crops can be entertained.

The seed is issued free, but the recipient is required to defray all forwarding and railway charges. Sufficient seed of each kind to sow

one-quarter to one-half an acre is supplied, and not more than three varieties can be sent to each applicant.

All applications should be addressed to the Chief Agriculturist and Botanist, Department of Agriculture, Salisbury.

Summer Crops.—Sixty day or kherson.

Rice.—Dryland or hill rice (for wet vlel soils). Imported varieties. Honduras, Fortune and Wartaribune.

Oil Seeds.—Linseed, sunflower, Spanish ground nuts.

Legumes.—White stingless velvet beans, common velvet bean, dolichos beans, sunn hemp (for green manuring), dhal, beggar weed (a valuable dryland substitute for lucerne), lupins (a green manure crop for sandy soil), Black-eyed Susan field pea, Kudzu vine, Tepary bean.

Hay Crops.—Teff grass, Sudan grass, manna, red manna.

Pasture Grasses.—Kikuyu, African Star grass, swamp couch grass, Rhodesian tussock grass, etc., as referred to in the *Rhodesia Agricultural Journal*, April, 1922. (A small number of roots.)

Miscellaneous Crops.—Buckwheat, niger oil (for green manuring), and sweet potato vine cuttings.

BOTANICAL SPECIMENS FOR IDENTIFICATION.

In all cases where a botanical identification is required it is of the utmost importance that the specimens reach the Department of Agriculture in a thoroughly dry condition, free from mildew, and intact, that is not broken in pieces. Whenever possible specimens should comprise main stem or small branch, leaves, flowers, seed vessels and roots or bulbs, though these need not necessarily be on the same plant.

The colour of the flowers and the general form of the plant should be preserved by pressing and drying between two sheets of blotting paper or newspaper. Ordinary plants not excessively succulent can be dried sufficiently in three days, provided the drying papers are changed every day. A heavy weight should be placed on the specimens in order to press them flat.

Correspondents are asked to supply the following particulars as far as possible:—

- (a) height and general appearance of plant or tree.
- (b) class of soil on which found;
- (c) locality and altitude;
- (d) supposed use or properties.

It is advised that specimens be packed between two sheets of cardboard or thin wood, since in this way they will travel long distances without fear of injury.

FARM SEEDS FOR SALE.

The undermentioned seeds grown on the Government experiment farms are offered for sale at the prices quoted. The quantities available are limited. Prices are f.o.r., Salisbury, or f.o.r., the Gwebi experiment farm. Owing to limited supply, the full delivery of any order cannot be guaranteed. Farmers are therefore requested not to enclose cheques until they are advised as to the amount of seed allotted to them. The seed is consigned carriage forward in the case of stations. In the case of sidings, the cost of railage will be notified after despatch. All applications for seed should be addressed to the Chief Agriculturist and Botanist, Department of Agriculture.

Spanish ground nuts (unshelled), selected, hand-picked seed	20/- per bag
Black-eyed Susan pea	25/- per 100 lbs.
Tepary bean	25/- per 100 lbs.
Sunn hemp	30/- per 100 lbs.
Sunflower, black (not guaranteed pure), from selected heads	15/- per 100 lbs.
Kherson oats	30/- per 100 lbs.
Teff grass	9d. per lb.
Sudan grass	9d. per lb.
Manna	4d. per lb.
Red manna	4d. per lb.
Linseed, white flowering	6d. per lb.
Majorda melon seed from selected melons	1/- per lb.
Pumpkin seed from selected pumpkins	2/6 per lb.
Sweet potato slips	10/- per bag

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 218. Useful Measurements for Maize, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 252. Cultural Notes on Buckwheat, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 396. Export of Maize.

- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.
 - No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
 - No. 400. Soil Washing, by A. C. Jennings, Assoc. Mem. Inst. C.E.
 - No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
 - No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia.
 - No. 408. The Velvet Bean, by J. A. T. Walters, B.A.
 - No. 416. Grasses of Agricultural Importance in Southern Rhodesia, by H. G. Mundy, F.L.S., G. N. Blackshaw, O.B.E., B.Sc., F.I.C., and E. V. Flack.
 - No. 417. The Ground Nut or Monkey Nut, by C. Mainwaring.
 - No. 422. Improvement of Rhodesian White Maize by Selection, by C Mainwaring.
 - No. 423. The Common Sunflower, by C. Mainwaring.
- Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
- No. 189. The Manuring of Maize on the Government Experiment Farm. Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
- No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs. Ph.D., B.Sc.
- No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
- No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs. Ph.D., B.Sc.
- No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
- No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
- No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
- No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
- No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
- No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
- No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 382. Annual Report of Experiments, Experiment Station, Salisbury. 1919-1920.
- No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
- No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
- No. 413. Arlington Sand Veld Experiment Station. First Report, by H. G. Mundy, F.L.S., and E. E. Wright.

TOBACCO.

- No. 132. Sumatra Tobacco. Hints to Rhodesian Growers, by C. J. Sketchlev
- No. 148. Darkling Beetle Grubs Injurious to Tobacco, by R. W. Jack, F.E.S.
- No. 168. Report on the Methods of Growing, Curing and Selling Bright Tobaccos in Virginia, U.S.A., by H. Kay Scorrer.

- No. 333. Tobacco Culture—Field Operations, by H. W. Taylor, B.Agr.
- No. 339. Tobacco Culture; Harvesting and Curing, by H. W. Taylor, B.Agr.
- No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
- No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
- No. 398. Wildfire and Angular Spot.
- No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision), by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.
- No. 410. Common Mistakes in Growing and Handling Virginia Tobacco, by H. W. Taylor, B.Agr.
Handbook of Tobacco Culture for Planters in Southern Rhodesia, price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
- No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood
- No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 247. Statistical Returns of Crops grown by Europeans in Southern Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S., Statistician
- No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
- No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.
- No. 361. Statistics of Live Stock and Animal Produce for the Year 1919, by F. Eyles, F.L.S.
- No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia, 1919-1920, by H. C. K. Fynn.
- No. 393. Statistics of Live Stock and Animal Produce for 1920, by H. C. K. Fynn.
- No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia for the season 1920-21, by H. C. K. Fynn.

LIVE STOCK.

- No. 145. Prospects of Importation of Cattle from Australia, by E. A. Nobbs, Ph.D., B.Sc.
- No. 208. Water in the Diet of Live Stock, by J. I. E. W. Bevan, M.R.C.V.S.
- No. 211. Fattening of Pigs on Granite Farms in Mashonaland, by R. C. Simmons.
- No. 227. An Experiment in Beef Production, by R. C. Simmons.
- No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
- No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by A. G. Holborow, F.I.C., Assistant Government Agricultural Chemist.
- No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.

- No. 255. Pound Fees.
- No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed Farms, by R. C. Simmons.
- No. 292. Branding and Drafting Pens, by R. C. Simmons.
- No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
- No. 336. Butchering and Flaying.
- No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
- No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
- No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
- No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.
- No. 421. From Breeder to Butcher: Cattle Feeding Experiment No. 9, Government experiment farm, Gwebi, by E. A. Nobbs, Ph.D., B.Sc., F.H.A.S.
- Arsenite Cattle Dip—How to Mix.

DAIRYING.

- No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.
- No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
- No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
- No. 356. Cream and its Production, by T. Hamilton.
- No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 395. Farm Butter Making, by T. Hamilton, M.A., N.D.D., N.D.A.
- No. 401. Milk Records and Milk Testing, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 418. Manufacture of Cheddar Cheese, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
- No. 95. Oestrus-Ovis in Sheep, by A. King.
- No. 121. Rabies, by Ll. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S.; D.V.H.
- No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
- No. 202. Distomatosis or Liver Fluke in Cattle and Sheep, by Rowland Williams, M.R.C.V.S.
- No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.
- No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by Ll. E. W. Bevan, M.R.C.V.S.
- No. 324. Infectious Abortion of Cattle, by Ll. E. W. Bevan, M.R.C.V.S. Services of Government Veterinary Surgeons.
- No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.
- No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.
- No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.
- Redwater Treatment and Gall Sickness.

IRRIGATION.

- No. 186. Concrete and Reinforced Concrete, by E. Hardcastle, M.I.E.E.
- No. 206. Hints on Irrigation: Small Earthen Storage Reservoirs, by W. M. Watt.
- No. 270. Odzani River Irrigation Scheme, by W. M. Watt.
- No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.
- No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
- No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.
- No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.
- No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
- No. 419. Irrigation Canals, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E. Engineering Advice.

FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.
- No. 217. Windbreaks and Hedges, by F. B. Willoughby.
- No. 267. Trees for Farm and Ornamental Purposes, by W. E. Dowsett.
- No. 366. The Management of Woods, by J. S. Henkel.
- No. 379. Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds.
- No. 386. Forestry in Rhodesia: Improvement Fellings on the Farm, by J. S. Henkel.

HORTICULTURE.

- No. 75. Fumigation of Fruit Trees with Hydrocyanic Acid Gas, by R. W. Jack, F.E.S.
- No. 354. The Home Orchard, by A. G. Turner.
- No. 424. Citrus Fruit Growing in Rhodesia, by A. G. Turner.

ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
- No. 147. Root Gallworm, by R. W. Jack, F.E.S.
- No. 158. Two Ladybirds Injurious to Potato Plants, by R. W. Jack, F.E.S.
- No. 171. The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants, by R. W. Jack, F.E.S.
- No. 172. Diseases of the Potato Tuber and the Selection of Sound Seed, by R. W. Jack, F.E.S.
- No. 178. Illustrations of Natural Forest in relation to Tsetse Fly, by R. W. Jack, F.E.S.
- No. 187. The Dusty Surface Beetle, by Rupert W. Jack, F.E.S.
- No. 197. Chafer Beetles, by R. W. Jack, F.E.S.
- No. 204. Some Injurious Caterpillars, by R. W. Jack, F.E.S.
- No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
- No. 219. More Household Insects, by R. Lowe Thompson, B.A.
- No. 228. Rhodesian Citrus Pests, by R. W. Jack, F.E.S.
- No. 233. Does it Pay to Spray Potatoes in Southern Rhodesia? by Rupert W. Jack, F.E.S.
- No. 249. Home-made Fly Papers, by Rupert W. Jack, F.E.S., Government Entomologist.

- No. 261. Turnip Sawfly, by R. W. Jack, F.E.S.
 No. 276. The Maize Stalk Borer, by Rupert W. Jack, F.E.S.
 No. 280. The Maize Beetle, by R. W. Jack, F.E.S.
 No. 290. Notes on Remedies for Turnip Sawfly, by Rupert W. Jack, F.E.S.
 No. 291. Cutworms, by Rupert W. Jack, F.E.S.
 No. 302. A Note on the Maize Stalk Borer, by Rupert W. Jack, F.E.S.
 No. 317. Maize Culture on Red Soil; Value of Poisoned Bait as an Aid to Good Stands, by Rupert W. Jack, F.E.S.
 No. 353. Further Experiments with Poisoned Bait on Maize Lands, by R. W. Jack, F.E.S.
 No. 369. The Bean Stem Weevil, by R. W. Jack, F.E.S.
 No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.
 No. 402. Ticks Infesting Domestic Animals in Southern Rhodesia, by R. W. Jack, F.E.S.
 No. 425. A Newly Recorded Pest of Maize: "Rootworm," by R. W. Jack, F.E.S.

POULTRY.

- No. 377. The Fowl Tick, by A. Little.
 No. 390. Poultry Husbandry: The Incubation and Rearing of Chicks, by A. Little.
 No. 406. The Turkey, by A. Little.
 No. 415. Mating for Improvement and Increased Egg Production, by A. Little.
 No. 420. Poultry Husbandry: Housing and Feeding of Adult Fowls, by A. Little.

MISCELLANEOUS.

- No. 93. Formation of Agricultural Credit Associations in Rhodesia, by Loudon M. Douglas, F.R.S.E.
 No. 129. How to Make Use of the "Fencing Ordinance, 1904," by N. H. Chataway.
 No. 226. Classification of Clouds, by R. H. Scott, F.R.S.
 No. 254. Hints on Explosives, by W. M. Watt.
 No. 264. Nature Notes—Adaptation, by C. F. M. Swynnerton, F.L.S.
 No. 273. Enkeldoorn Produce Express Syndicate Rules.
 No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.
 No. 283. Maize Foods for the Home.
 No. 294. Directions for taking Samples for Analysis, by E. V. Flack, Acting Agricultural Chemist.
 No. 318. Notes on Mining Law for Farmers, by Advocate D. E. McCausland, M.A., LL.B.
 No. 358. Notes on the Regulations governing the Sale of Fertilisers and Farm Foods, by E. V. Flack.
 No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
 No. 391. Hints on Brickmaking, by G. T. Dyke.
 No. 414. Limestones in Southern Rhodesia, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
 Malarial Fever: How it is caused and how it may be prevented, by Sir Ronald Ross, F.R.C.S., D.Sc., LL.D., F.R.S., K.C.B., etc.
 Directory of Rhodesian Farmers and Ranchers.
 The Analyses of Agricultural Products, Soils, Water, etc.
 Lectures for Farmers.

Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 223.]

[26th May, 1922.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to declare the farm Dunstal, sub-division 3, in the district of Bulawayo, an area infected with swine fever, and to prohibit the removal of pigs therefrom except with permission of the Controller of Stock.

No. 257.]

[23rd June, 1922.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notices Nos. 387 and 531 of 1914, 400 of 1915, 305 and 341 of 1916, and 413 of 1918, declaring areas for transport cattle.

No. 271.]

[30th June, 1922.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to declare, in terms of section 17 of Government Notice No. 21 of 1917, the following areas of infection and guard area :—

CHARTER AND CHILIMANZI NATIVE DISTRICTS.

(a) *Areas of Infection.*

1. The Wiltshire and Worcestershire Estates.
2. The farm Swartfontein.
3. The farm Chipisa.
4. The farm Mooifontein.

HARTLEY, MARANDELLAS, CHARTER, CHILIMANZI AND GUTU NATIVE DISTRICTS.

(b) *Guard Area.*

An area bounded by and including the farms Palmiet Vlei, Mserenge, Glynn, Bucknall, Sunnyside, Balmoral, Corfe, Par, Clanwilliam, Beer, Lovedale, Pilgrims' Rest, Mizpah, Wedge, Hopley's, Skipton, Imboga, Goto and Rundu; thence down the Sabi River to its junction with the Rumwengi River; thence up the latter to its headwaters; thence in a south-easterly direction to the headwaters of the Nyamhonga River and down this river to its junction with the Nyadzidza River, and up the latter to Eastdale East; thence by and including Eastdale East and Eastdale Estate, but

excluding that portion of the latter lying south of the Gutu Road; thence by and including Widgeon, Shasha Fountains, Driefontein B, Sessebi, and Chakaastad; thence along the northern boundary of the Chilimanzi Reserve and along the boundaries of the Chilimanzi and Charter native districts to the farm first named.

No. 243.]

[9th June, 1922.

IT is hereby notified that His Honour the Administrator has been pleased to cancel from date hereof Government Notice No. 103 of 1922, and under and by virtue of the powers conferred upon him by the "Importation of Plants Regulation Ordinance, 1904," to prohibit the introduction of citrus trees into Southern Rhodesia from the Provinces of the Cape of Good Hope and Natal of the Union of South Africa.

No. 248.]

[9th June, 1922.

IT is hereby notified that His Honour the Administrator has been pleased, in terms of section 4 (2) of the "Game Law Consolidation Ordinance, 1906," to suspend until 31st October, 1922, the operation of section 9 of the said Ordinance in so far as it relates to the killing, hunting or capture of game, with the exception of birds, in class "A" in the native districts of—

Insize	Victoria	Charter
Matobo	Ndanga	Umtali
Bubi	Chibi	Melsetter
Gwanda	Bikita	Inyanga
Umzingwane	Gutu	Sebungwe
Belingwe	Marandellas	

No. 316.]

[21st July, 1922.

IT is hereby notified that His Honour the Administrator has been pleased, in terms of section 25 of the "Water Ordinance, 1913," to approve of the following regulations for the grant of irrigation loans:—

1. Applications for loans in terms of section 22 of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920," shall be made substantially in the form "A L" annexed hereto; and shall be accompanied by such reports, plans, specifications and estimates as may be required.

2. If the amount of the loan applied for does not exceed £500, the following information must be furnished with the application:—

(a) A full description of the proposed scheme and its objects, with a general plan, drawn approximately to scale, of the locality, showing the rivers, farms, roads, railways and other features, also the location of the proposed works and irrigable lands in respect thereto.

(b) Specifications of methods to be adopted and of materials to be used in the construction of the works.

(c) In the case of storage dams, longitudinal sections along line of proposed dam, nature of foundations, materials available for construction, cross section of dam, approximate capacity of reservoir, area and nature of catchment, and estimate of supply available.

(d) In the case of diversion weirs, longitudinal sections along line of proposed weir, nature of foundations and abutments, materials available for construction, cross section of weir, nature of supply, frequency and intensity of floods, character and quantity of silt carried.

(e) In the case of pumping schemes, further particulars regarding the same must be supplied as set forth in section 4 of these regulations.

(f) Grading, sections and capacity of furrows and nature of ground traversed by furrows.

(g) Extent and nature of land to be irrigated, together with a report by an independent farmer or agricultural expert approved by the Administrator as to the quality and suitability of the land for irrigation, and the class, quality and estimated yield of crops which could be profitably grown thereon under irrigation.

(h) Estimate of cost of proposed scheme.

(i) Such further information as the Administrator may require.

3. If the amount of the loan applied for exceeds £500, the following information must be furnished with the application :—

(a) A report prepared by a qualified civil or hydraulic engineer on the proposed scheme or project, giving the fullest possible particulars of the locality, average rainfall, run-off, yield, river gaugings, supply available, intensity and frequency of floods, irrigable areas, description of proposed irrigation works. A report by an independent farmer or agricultural expert approved by the Administrator as to the quality and suitability of the land for irrigation, and the class, quality and estimated yield of crops likely to be grown thereon under irrigation.

Also such further information as may be necessary to enable the Administrator to test the value of the scheme from engineering, agricultural and financial points of view.

(b) Detailed estimates of the cost of the scheme.

(c) Specifications of the methods to be adopted and of the materials to be used in the construction of the works.

(d) Index plan of scheme showing all places mentioned in the report, catchment areas, rivers, streams, roads, railways, farm boundaries, natural features, the positions and lines of existing and proposed works, and the irrigated (if any) and irrigable lands to a scale of not less than one inch to every two miles.

(e) Contoured plan of reservoir and dam site, in the case of a storage scheme, to a scale of not less than one inch to every 500 feet, showing contours not less frequently than every five feet, with table of capacities attached in units of cubic feet.

(f) Contoured plan of the irrigated (if any) and irrigable lands showing the boundaries, beacons, areas, name of each property concerned, and name of the registered owner of the same, together with all important topographical features, and giving the lines of existing (if any) and proposed canals, distributaries, laterals, etc., and the positions of all other irrigation works to a scale of not less than one inch to every 500 feet.

(g) Longitudinal sections of canals showing the reduced levels of natural surface and bed levels, proposed gradients, bed widths, full supply depths, capacities, datum, etc., to a scale of not less than one inch to every ten feet vertical.

(h) Plans and longitudinal sections of dams, waste weirs and diversion weirs, showing the positions and nature of trial holes (if any) and, if possible, the solid rock line for foundations, to scales of not less than one inch to every 250 feet horizontal and one inch to every ten feet vertical.

(i) Cross sections of dams, waste weirs, diversion weirs and canals to a natural scale of not less than one inch to every twenty feet.

(j) Drawings of detail of outlets, sluices, syphons, escapes, falls, regulators, valve-towers, bridges, etc., to a scale of not less than one inch to every eight feet.

4. In the case of pumping schemes the following special information must be furnished :—

- (a) Full particulars regarding source of supply, site of pumping plant, general type of plant required and suitability of site for the erection thereof.
- (b) Contoured site plan of pump and pumping stations to a scale of not less than one inch to every ten feet.
- (c) Longitudinal sections of pumping main, including both suction and delivery.
- (d) Altitude above sea level where plant is to work.
- (e) Quantity of water to be pumped per minute.
- (f) Greatest height water is to be pumped, including suction (actual lift only, exclusive of friction head in pipes).
- (g) Greatest height of suction lift.
- (h) Total length of pumping main, including suction and delivery.
- (i) Diameters of pumping main (internal).
- (j) Kind of pipes required.
- (k) Hours during which it is proposed to run engine continuously.
- (l) Type of engine which it is proposed to use.
- (m) Brake h.p. required (measured at sea level).
- (n) Type of pump required.
- (o) Such further information as the Administrator may require.

5. Unless special circumstances exist, no drawings should be larger than the size known as "double elephant" (40 inches by 27 inches), and every drawing should be numbered, titled, signed and dated, and should have the scale or scales, and north point true or magnetic or both, clearly shown thereon.

6. Except where otherwise specially provided in these regulations, every longitudinal section shall be drawn to the same horizontal scale as the corresponding plan, and shall show the surface of the ground, the intended level of the proposed works, the height of every embankment and the depth of every cutting, and shall likewise show a horizontal datum line, which shall be the same throughout the whole length of the proposed work and for every proposed branch of such work. Such datum shall be referred to some fixed bench mark (stated in writing in the section).

7. The plans and section may be on drawing paper or tracing cloth, or be black and white or other prints. All necessary dimensions, reduced levels and explanatory notes shall be shown thereon. Tracings must not be coloured or folded.

8. The Administrator, if not satisfied with any valuation of land or immovable property by an applicant, may require a further valuation by some person appointed by him, and the cost thereof shall be borne by the applicant.

9. The security required for a loan shall take the form of a mortgage on immovable property, provided that the Administrator may, in case the loan does not exceed £500, authorise security therefor in the form of two sureties who shall be owners of immovable property in Southern Rhodesia.

10. All applications made in the prescribed form shall be examined by the Government Irrigation Engineer, who shall furnish a report to the Administrator as to the suitability of the proposed works.

11. After the Administrator has authorised the grant of a loan and the applicant signifies in writing that he is ready to commence the works, he shall be paid an amount not exceeding one-fifth of the total amount of the loan, and from time to time thereafter, upon the certificate of the Government Irrigation Engineer as to the quantity and estimated value of the work done, such further instalments of the loan as the Administrator deems fit, provided that no instalment of the loan shall be paid unless the Administrator is satisfied that the work, if not already begun, will be carried out, or if begun, has been and will be carried out in accordance with the plans, estimates and specifications as finally approved.

12. Interest shall be calculated at such rate not exceeding 10 per

cent. per annum as the Administrator may fix on any loan or instalment thereof from the date on which it is advanced or paid.

13. The period of redemption for a loan not exceeding £500 shall not exceed ten years, and for a loan exceeding £500 fifteen years. Payments shall begin on the first day of January or the first day of July, as the Administrator may decide, being not later than two years from the date upon which the works have been completed.

14. Should the works not be completed within the time specified in the application, the first payment shall become due and payable within two years from the date when the works should have been completed.

15. Interest payable between the date of the first advance and the date prescribed under sections 13 and 14 of these regulations for the commencement of the period of redemption may be added to the amount of the loan and form part of it for the purposes of redemption, but not for interest.

16. The loan may at any time be partially or entirely redeemed by payment of any sum in addition to the half-yearly payments, and thereafter if any balance be left, the payments shall be reduced accordingly.

17. The period of redemption may at the request of the borrower be lessened at any time, provided a corresponding increase be made in the half-yearly payments.

18. The transfer of any property which is hypothecated as security for an irrigation loan shall not be passed in the Deeds Office until the redemption charges due at the date of the proposed transfer shall have been paid and the consent of the Administrator to such transfer shall have been obtained.

FORM "A L."

Application for Irrigation Loan under the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

To His Honour the Administrator,
Salisbury.

District.....

- (1) Full name and address of applicant.....
- (2) Name of farm or farms upon which the works for which the loan is sought are to be carried out.....
Is the applicant (i.) owner, (ii.) tenant, (iii.) under permit of occupation?.....
- (3) Name of farm or farms to be mortgaged and district. If the amount of the loan applied for does not exceed £500, and the applicant desires that the security offered should consist of two sureties who are owners of immovable property in Southern Rhodesia, their names and a description of the immovable property owned by them should be given.....
- (4) Is the land offered as security already mortgaged or otherwise encumbered? If so (a) to what amount, (b) to whom, (c) address.....
- (5) (a) Is the applicant sole or joint owner of the property?.....
(b) If the latter, what share does he own?.....
(c) Is this share divided or undivided?.....
- (6) Is the applicant owner of any other land? If so, is there any mortgage thereon, and what is the amount?.....
- (7) What is the present valuation of the property on which the works are to be carried out?.....

- (8) (a) How much does the applicant estimate the value of the property will be enhanced by the proposed works?.....
 (b) What are the reasons for the estimate of increased value?.....

 (9) What is the amount of the loan desired?.....
 (10) For what period is the loan required?.....
 (11) Describe briefly the nature and purpose of the proposed work, stating extent of land to be irrigated or drained.....
 (12) What is the estimated cost of construction of the proposed work?.....

 (13) State the name and distance of the nearest town or village, and of the nearest railway or siding.....
 (14) Have rights to water been obtained in respect to the proposed scheme?.....

 (15) State the time in which the works will be completed.

Signature of Applicant

Date.....

— THE —

Veterinary Vaccine Agency

Supply Reliable Curative and Preventative Vaccines

FOR ALL STOCK DISEASES

AGGRESSIN (Globe) Prevents BLACK LEG

Life immunity from one inoculation. 1/- per dose.

McGarvie Smith VACCINE Prevents ANTHRAX

Life immunity after second inoculation. 8d. per dose.

Harber's ANTITOXIN Cures GALLSICKNESS. 7/6.

Abortion, White Scour, Pneumonia, Strangles and Distemper Vaccines, on application.

Reliable Syringes and Veterinary Instruments Supplied

Burdizzo and other Castrators, Syringes, Needles, Thermometers, etc.

S. I. JOHNSTON, Veterinary Surgeon, Managing Director,

64 Winchester House, Box 6541, JOHANNESBURG

Telegrams: "Aggressin." Telephone 6537.

Sub-Agents, S. Rhodesia - Power & New, Salisbury
do N. Rhodesia - H. B. Rutherford, Menze Siding



Mr T. B. Hepburn's homestead near Bulawayo



Homestead of Mr. P. O. Brocklehurst, Belvoir Spinney, Charter



THE RHODESIA
Agricultural Journal.

Issued by the Department of Agriculture.

PUBLISHED BI-MONTHLY.

Subscription : 5/- per annum.

VOL. XIX.]

OCTOBER, 1922.

[No. 5.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to :—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

A Pisé de Terre House.—On the opposite page we reproduce a photograph of a house built in pisé de terre by Mr. T. B. Hepburn near Bulawayo. The material used is schist rubble ("formation"), moistened with a little slimed black vlel clay. The aggregate resembles the concrete mixture used in cement work, being small stones and rubble held together by the clay and finer soil; the result is very satisfactory. The walls are extremely strong, and there is not a semblance of a crack throughout the building. In two of the walls five feet semi-circular arches have been cut out and stand perfectly sound without any re-inforcement. All exposed portions of the building are cement plastered. Before applying the cement, the face of the wall was chipped, and owing to the rubble this gives a very rough surface, to which the cement adheres firmly.

This class of work gives great scope to even the amateur working with unskilled labour. No skilled labour was employed in the building of this house, nor had any of those employed ever attempted pisé work before.

In striking contrast we also give an illustration of a granite house, the home of Mr. P. O. Brocklehurst, Belvoir Spinney, Charter.

Maize Matters.—The annual general meeting of the Maize Breeders and Growers' Association was held in Salisbury on the 31st August. Mr. A. R. Morkel presided over an attendance of about thirty members, and in an interesting *resumé* of the year's work expressed the opinion that on the whole the past season of drought would be more profitable to farmers than the previous season of plenty and poor prices. The matter of the affiliation of the association with the Rhodesia Agricultural Union was a prominent item on the agenda, and evoked considerable discussion. It was eventually decided to appoint a committee to approach the Rhodesia Agricultural Union for the purpose of arranging terms of affiliation.

A brief reference was made to the co-operative maize growing experiments which are being carried out by members of the association in co-operation with the Agricultural Department. These consist of a simple rotation experiment conducted on 25 acres, a series of fertiliser experiments on a similar area and a series of green manuring experiments. It is hoped that one or two members of the association in all maize growing districts will undertake to carry out one of these series, so that in each important maize producing area there will be two or more of each of these trials in progress for the next four or five years. It is suggested that the experimenters should supply reports of their results each season to the Department of Agriculture, by whom they will be compiled and a summary presented at the end of each season at the annual general meeting of the association.

Mr. A. R. Morkel was re-elected president of the association for the ensuing year, and Messrs. H. B. Christian and F. C. Peek vice-presidents. The old committee was re-elected *en bloc*, with the exception of Mr. R. S. Newett, who was compelled to resign owing to other more pressing duties, and who was replaced by Mr. J. Dennis.

Seed Maize.—Amongst matters of primary importance dealt with at the meeting referred to in the foregoing was a resolution moved by Mr. J. Dennis, to the effect that all members of the Maize Breeders' Association should pledge themselves to select and offer for sale for seed purposes only maize which had been hand-selected, hand-shelled, tipped and butted, true to type and breed, and should discourage the practice of growers offering for sale so-called seed taken from the power sheller, which could correctly only be termed commercial grain. After considerable discussion it was decided that the passing of such a resolution would be of little value, since at the present time •

the association was not in a position to exact any penalty from a member who might flagrantly neglect to carry out the principle expressed in the motion. It was suggested that should the association affiliate with the Rhodesia Agricultural Union, and should there later be more funds available for the carrying on of the association, it might be possible to place in the secretary's office samples of seed of all the principal growers, together with a statement of the prices at which they were prepared to sell. Anyone wishing to purchase seed maize could then communicate with the secretary and receive quotations; should any grower then fail to supply seed up to the standard of his sample, his name might be removed from the list of members whose seed was recommended and vouched for by the association. As an alternative, such a grower might be black-listed as a grower of reliable seed. While the principle underlying Mr. Dennis's motion was cordially supported, it was decided to leave the matter over until a decision had been arrived at regarding the affiliation of the association with the Rhodesia Agricultural Union.

An equally important resolution on much the same subject, but one involving fewer difficulties in its execution, was passed unanimously. This read as follows:—"That in future, in order to further promote production of pedigree seed, all maize exhibitors shall be required to supply to the show secretary a certificate guaranteeing that the maize exhibited in any named class is the genuine product produced from seed of the same named breed or type and of no other." The object of this is to overcome a serious objection which has often arisen in the past, namely, an exhibitor being free to select any exhibit of ears not necessarily of the breed which he may be growing, enter it in a named class, possibly win high honours with it, and so secure advertisement as a grower of a breed, the type of which he has not fixed and the appearance of which in his crop was more or less fortuitous. For example, in the past there has been nothing to prevent an exhibitor from selecting exhibits of both Louisiana Hickory and Salisbury White from a crop of the latter breed. He may win with his Louisiana and be beaten with his Salisbury White, although the latter is the breed which he is specialising in. It follows that the grower of such an exhibit might earn an undeserved reputation as a producer of seed of a breed which had made its appearance in his crop by accident rather than by design, and which would not be reproduced to any considerable extent in a resulting crop raised from that seed. The resolution which has now been passed makes it incumbent upon the grower to sign a certificate guaranteeing that the maize he exhibits is truly representative of the breed which he is using his best efforts to standardise and improve.

Yellow v. White Maize.—The question of legislation governing the growing of yellow maize in the maize belt was also discussed at the meeting. It will be remembered that this was brought up at the last session of the Legislative Council, but the Government felt that the matter was of such importance that all interests should be con-

sulted before any definite step was taken towards the introduction of legislation. The meeting decided to appoint a small committee to go into the subject of zones within which the growing of yellow maize should be prohibited, and in particular to report whether such zones should include or exclude native reserves lying adjacent to maize belt farms.

Costs of Maize Production.—Some discussion took place regarding the forms which have been issued by the association to its members calling for a return of the costs of maize production by each individual member, and other returns of a like nature. There has been a certain amount of feeling amongst farmers that the information called for was of so confidential a nature that it was undesirable it should be dealt with in any other manner than as strictly confidential. For this reason it was thought that the movement would obtain greater support from members if it was decided to submit the reports to the Department of Agriculture instead of to the secretary of the Maize Association. It was therefore decided to communicate with the Director of Agriculture and ask him to permit these forms being sent to the branch of agriculture and botany, by the officials of which the association was satisfied the information would be treated as confidential. Subject to the approval of the Director of Agriculture, Mr. Mundy undertook, on behalf of his branch, to receive the reports and to compile and tabulate particulars supplied into a general report on this aspect of maize production.

High and Low Veld Maize.—The last matter dealt with at the meeting was that of separate classes at our agricultural shows for high and low veld maize. Correspondence was read by the chairman from Messrs. Mundy and Walters in which various alternative suggestions were made regarding the lines of demarcation which should be drawn. As was pointed out in these letters, the question is not one which should be settled off-hand, as there are many conflicting interests to be considered. For instance, if the 4,500 line of altitude were adopted and all areas below this competed in the low veld classes and all above in high veld classes, maize growing areas such as Victoria, Hartley, Makwiro, Inyazura and Umtali would all fall into the same low veld class, and would have to compete against the Mazoe and Lomagundi districts. On the other hand, the high veld area would be very restricted in size and total production. One of the objects of the line of demarcation is to give less advanced or less naturally favoured districts a better opportunity of competing with success, and so to encourage growers in such areas to compete on the Salisbury Show.

It was finally decided to publish the correspondence and so make available to members all that has transpired. A decision on the subject was postponed until the next general meeting, which will still be in time to allow of the necessary arrangements being made on next year's Salisbury Show.

The Salisbury Show.—The Salisbury Show, held on the 8th, 9th and 10th August, under the auspices of the Rhodesian Agricultural and Horticultural Society, eclipsed all previous records and achieved a success which must be very gratifying to the executive and the secretary, Mr. T. Deas. It gives us great pleasure to add our meed of praise to the eulogiums bestowed and to testify to the very important part which this Show is taking in the development of the agricultural industry of this country. The Salisbury Show is now noted far beyond our borders, and as a means of demonstrating the all-round high quality of our various farm products and the potentialities of the country it is serving a purpose which it is difficult to over-estimate. The Prime Minister of the Union, General Smuts, opened the Show, and in one of his subsequent speeches he said:—"I spent two days at your Show, and let me tell you without any flattery, and I hope without exaggeration, that any part of South Africa might have been proud of the Show that you have just had in this city. Nothing to me has been more convincing, nothing more striking of your character, of the great effort that you have made and the success that you have achieved, than this Show."

To those who have watched the rise of this Show from very small beginnings, the progress that has been made during the past few years is most gratifying. The Salisbury Show is indicative of the pastoral and agricultural activities of this country, and every product of any importance finds a place in the exhibits. Cattle, maize, tobacco, wheat and citrus fruits are the main features, and these were worthily represented. We have not the space to enter into a detailed description of the exhibits, and this is not necessary, for the daily Press have published full accounts of what was on view.

As regards cattle, the entries exceeded the previous year's record, and were even greater than those at the Bulawayo Show last May. All the best-known British breeds were strongly represented, although it must be admitted that in certain classes there were animals which should not have been exhibited. The presence of competitors from the Union is most welcome, and we hope to see our friends from the south in stronger force next year. The blue riband of the Show—the Milne trophy—went to that fine specimen of the Shorthorn breed, "County Magistrate," which has a long list of successes to his credit, and was only just beaten at Bulawayo for the Thousand Guinea trophy by that redoubtable Aberdeen Angus bull, "Village Editor," owned by Capt. Phillips. Shorthorns were, on the whole, a strong class, although it was a curious fact that at the sale held later difficulty was experienced in disposing of the animals offered. It is understood, however, that most, if not all, were afterwards sold privately at satisfactory prices. The Aberdeen Angus breed is gaining in popularity, and there were some fine animals on show. Messrs. J. J. and D. Black, who are farming near Salisbury, were conspicuous exhibitors in these classes, and have every reason to be proud of their results. "Black Band II. of Castlecraig," Mr. J. R. Stewart's well-known bull, was of course in evidence, and caused the judges considerable deliberation before awarding the Milne trophy to the Shorthorn. Herefords were a strong class, both as regards numbers and quality.

The Friesland and South Devon classes were augmented by animals brought up from the Union, and which subsequently sold well.

It is pleasing to record that the milking competition received more support this year than in the past. The first prize of twenty guineas, presented by Mr. B. I. Collings, was won by Mr. J. S. Struthers, Palm Tree, Sinoia, whose cow produced 72 lbs. of milk in two days' milking, with an average butter fat percentage of 3.5. Full details appear elsewhere in this issue.

Maize is always a prominent exhibit on the Salisbury Show, and is indicative of the importance of the crop in our farming practice. It might reasonably have been expected that in consequence of the drought which occurred at the most critical period of the season the exhibits would be few in number and inferior in quality. This was not so, and while the entries were less than those of last year, and the quality not quite so good, the display was still of outstanding merit. The Mashonaland public take a keen interest in the maize exhibition and follow closely the competition in the various classes. Messrs. Glanfield & Rattray secured the grand championship with 300 ears of 8-row Hickory King, which, though not so weighty as have been some of their exhibits in the past, was yet remarkable for its general uniformity and trueness to type. Mr. D. W. Bean, of Shamva, last year's grand champion winner, was runner-up with a wonderfully weighty 300 ears of Salisbury White. The same gentleman was adjudged to have made the premier exhibit of any variety in the 100 ears classes. Mr. E. S. White, of Concession, came first in the class for 300 ears Louisiana Hickory. Both this breed and Salisbury White are each year showing a marked advance in uniformity and trueness to type. The competition throughout the classes was exceedingly keen.

The tobacco exhibit aroused the enthusiasm of the judges, and demonstrated in a convincing manner the suitability of Southern Rhodesia for the growing of high quality leaf. The exhibit was the largest that has ever been staged in this Territory, and in the opinion of Mr. Scherffius, the Union Government expert, was the finest he has seen in South Africa. The commercial exhibits of baled tobacco showed that growers are becoming skilled in the art of farm grading and preparing their leaf for market. This feature of the tobacco section should be encouraged, as farm grading will greatly assist in the production of better quality leaf. Agricultural Shows largely reflect the progress of the farming community, and if the recent Show indicates the status of the tobacco industry, the growers of Southern Rhodesia are to be congratulated.

The citrus fruit display was extremely creditable, and fully representative of this progressing industry. Competition was very keen, and the judge's powers of discrimination were severely taxed. The samples packed for export were typical of the fruit which is now being sent overseas and securing remunerative prices.

Amongst other sections, the pig exhibits were of exceptional merit, and some fine specimens of Berkshires, Large Blacks and Middle York-



General Smuts opening the Salisbury Show Photo by Mr. A Mathers,
Edinburgh Press

shire Whites were on view. Sheep were also a strong class, and a marked improvement on previous years, while the exhibits of poultry were much in excess of the accommodation.

The Salisbury Show has now reached such dimensions that three days is none too long a period to devote to the inspection of the various classes. Other attractions, such as the exhibits in the Women's Industrial Hall, those of the Department of Agriculture, the products shown by commercial firms, the implement display, the dog show and tillage demonstration, all engaged the attention, dissipating the time "in manner most disconcerting." One and all contributed to make the Show memorable in the history of Mashonaland, and to set up a standard which it will be hard to surpass.

Children's Cattle Judging Competition.—A novel and highly interesting feature at the Salisbury Show was the children's cattle judging competition for prizes of £10, donated by Mr. W. H. Williamson, and £5 by Mr. R. B. Mitchell. Boys and girls under seventeen years of age to the number of ninety competed. Five grade Shorthorn oxen were paraded before them, and the candidates were required, with the guidance of a score card, to place them in order and indicate by points the relative merits of the animals. Their opinions so recorded were collected and compared with that of Mr. R. Abbott, of Natal, the cattle judge, and those nearest to his adjudication were further orally examined by him and given an opportunity of explaining to him the reason for their judgment. The winners thus selected were:—1, Jack Huddy; 2, Joyce Tolmay; 3, Harold Flowers; 4, Jennie Davison; 5, Katherine Smith.

The value of such a competition lies chiefly in the interest awakened in the rising generation, focussing the children's attention at a susceptible age in a manner which may have far-reaching effects in the future. The competition was an undoubted success, but the experience gained on this the first occasion will make it possible to improve it in details next year. Appreciation is due to the donors of the prizes, not only for their generosity, but also for initiating the idea, which has been shown to be both practical and useful in application.

In this connection a valued correspondent sends us an extract from *Modern Farming* for August, 1922, relating to a similar contest held for the first time at the Royal Agricultural Show of England, in which a team of two boys and a girl, representing the Young Farmers' Clubs of England, competed against the winning team from Maryland, U.S.A., the winners of a corresponding national contest in the United States. It is recorded that the American team won with a margin. It is interesting to find that, independently and without knowledge of the Young Farmers' Club movement going on in other English speaking countries, we in Rhodesia are working on similar lines. Perhaps one day a Rhodesian team may compete in England or America.

The Pig Industry.—A successful meeting of persons interested in pig breeding was held in Salisbury on the third day of the Agricultural Show, Dr. Eric Nobbs, Director of Agriculture, presiding. The attendance, which numbered about forty, included Mr. Bawden, managing director of the Estcourt Bacon Factory, and Messrs. W. Pepworth and R. Abbott, who are well known breeders of pigs in Natal. The meeting, to which reference was made in the August issue of this *Journal*, was called for the purpose of discussing ways and means of organising the pig breeding industry of Southern Rhodesia. Mr. T. Hamilton, Dairy Expert, in emphasising the imperative need for prompt action, drew attention to the large number of pigs of inferior quality in the country and to the unsatisfactory type of animal being sent to the factories. The pig breeding industry was, he said, in a precarious position, and already our markets were being invaded by imports from the Union. In the debate that followed the necessity for a standardised system of registration was advocated, and a suggestion was made that a Rhodesian Pig Breeders' Society be formed. Dr. Nobbs, however, pointed out that the Government had agreed to recognise only the Stud Books of the South African Stud Breeders' Association, of which the Pig Breeders' Society formed part. He thought that the Society would welcome the formation of a Rhodesian committee to control pedigree pig breeding in this country, but he pointed out that even with the appointment of this committee it would still be necessary to register pedigree pigs at the headquarters of the Society in Capetown. A second suggestion was that pigs should be inspected locally prior to registration to ensure that they are up to the standard of excellence required by the particular breed represented. A further suggestion was that pigs thus passed into the Stud Book should be marked with some distinctive mark.

A temporary committee consisting of the following gentlemen was appointed to go into these matters:—Messrs. T. Bradshaw, D. W. Bean, E. S. White and Leo. Robinson, with Mr. T. Hamilton as acting honorary secretary. It was decided subsequently to communicate with the secretary of the Pig Breeders' Society of South Africa, and the following is his reply:—

"As the law stands at present there can be only one Society (i.e., the S.A. Pig Breeders' Society) dealing with the registration of pigs both in the Union and Rhodesia. . . . I do hope you will work on the lines of starting a branch of this Society in Rhodesia. . . . Distances are so enormous that it is inadvisable to concentrate all this work at a central office. What I think we ought to aim at is a central office with branches in all the Provinces of the Union and Rhodesia. Registrations would still be dealt with by the central office, but there would be plenty of scope for local bodies, particularly in regard to dissemination of information, improvement of the raw product and, most important of all, marketing and the development of the export trade.

"The question of inspection prior to registration has frequently been discussed, but expense has always stood in its way. In the case of pigs, a breeder cannot wait until the inspector comes on his rounds.

He must sell when he gets a chance, otherwise all his profit is eaten up. . . . My personal opinion is that what we need more than inspection is education. We are passing through a phase which I have no doubt other countries have gone through when owners seem to consider that the progeny of a registered sire and registered dam must of necessity be fit for sale as a stud animal. This is not only the case with pigs, but with cattle too. Some societies seem to think that the panacea for this evil is inspection. Inspection would certainly do a certain amount of good by eliminating undesirable animals, but you cannot very well cut out mediocre pure-bred animals, for which there is probably a larger demand than for the tip-toppers, as price enters very largely into the question. Breeders should act as their own inspectors; they will be forced to realise that it is in their own interests only to sell the best for stud purposes, and that every animal they send out is either a good or bad advertisement. In the case of the Large Black Pig Society, however, animals intended for exportation are inspected before a certificate is issued to them. These are only my personal views; the majority of the Council are, I think, in favour of a system of inspection.

"I am quite in accord with the suggestion of distinctive marking of animals accepted for registration, but the matter would have to come before the Council for approval. My idea is that each animal should have an ear tag with the number corresponding to its registered stud book number.

"The trouble I foresee is that many tags will get torn out and there will be constant demands for duplicates. No really satisfactory ear tag has yet been invented. They are quite all right so long as animals are kept in sties, but not when they are running in bush country or get mixed up with barbed wire."

The terms of this letter are now under consideration by the committee referred to, and it is hoped shortly to submit a concrete scheme for the consideration and adoption of those concerned.

Cotton.—We hear that a movement is on foot to establish a cotton ginnery and a press at Vila Pery, in the Mozambique Company's territory, and that should this eventuate a considerable acreage of cotton is likely to be sown in that neighbourhood. Should the proposal be realised, and should the press be sufficiently powerful to furnish bales of a density that will enable them to be profitably exported oversea, this enterprise may expect to obtain cotton also from Southern Rhodesia. There are many farmers here who are anxious to grow the crop, but the unfortunate failure of the presses provided by the British Cotton Growers' Association to compress the lint sufficiently for transport discouraged cultivation altogether. By a combination of the growers of both territories the proposed ginnery may be actively employed for a sufficiently long period each year to render the enterprise profitable. The development of the scheme will therefore be watched with interest by Rhodesian farmers.

Milk Records.—Elsewhere in this issue will be found the list of Rhodesian milk records brought up to date. The owner of the most outstanding cows is Mr. J. S. Struthers, of Palm Tree, Sinoia. Most of his cows have now completed their lactation, and it is interesting to compare the total of the butter fat production with that laid down in the Union official milk record scheme for admission to the Advanced Register. The requirements for admission to the Advanced Register of cows entered in the two year class are laid down as follows:—

“Cows calving at exactly $2\frac{1}{2}$ years of age or under and under 3 years. Requirements: to produce 225 lbs. of butter fat in 300 days or less.”

Mr. Struthers' cow “Rosebud” was born on the 22nd November, 1919, and calved on the 6th October, 1921. She therefore comes in the two-year-old class. Her actual production is 227.42 lbs. butter fat, and “Rosebud” would therefore be eligible for the Advanced Register if entered for the official test. All the cows belonging to Mr. Struthers in the Rhodesian milk records were bred by the owner, and it is pleasing to note that, in spite of a long and tiring journey by road and rail, his cow “Daisy” won the first prize in the milking competition at the Salisbury Show. It is encouraging to add that several further owners have signified their intention of entering cows for the milk records in the coming season.

It is to be hoped that every owner will do his utmost to give the monthly butter fat test as well as the weight of milk produced. The butter fat return is most important, and it is on this return alone that cows are admitted to the Advanced Register in the official test.

The Rhodesia Egg Circle.—The egg circle, in connection with which an inaugural meeting was held in Salisbury some five months ago, has not received the support necessary to commence operations. Up to date only sixty-four persons have joined the circle, and but £131 have been subscribed out of a total of £300 required to cover initial expenditure. The sixty-four members are distributed as follows:—Gwelo district, 31; Salisbury district, 21; Bulawayo district, 8; Umtali district, 4. The objects of the egg circle have been fully explained in the Press and at public meetings, and the scheme has certainly not lacked publicity. The movement is entirely a co-operative one, managed and controlled by members for their mutual benefit. It is therefore surprising that the egg circle has not received more support than it has. The position now is that unless the balance of the £300 required is forthcoming within a reasonable time, the scheme will have to be abandoned. This would be regrettable, for an organisation such as is proposed is capable of achieving much good. It will also be an instrument of the utmost value when the time comes for looking beyond our borders for markets for our eggs. Other countries have adopted the principle with success, and as an instance the Cape egg circle which operates in the Peninsula may be cited. The financial year of this circle has just concluded with a profit of £500 on a share

capital of £820, and the members have been paid a dividend of 6 per cent. on their shares and a bonus of 6 per cent. on the value of eggs supplied. Most important of all, members have received top prices for their eggs.

The prices obtaining for eggs in Rhodesia at the present time should be sufficient inducement to enlist the support of the great majority of poultry keepers. The wide fluctuations which occur at various periods of the year are unsatisfactory alike to the consumer and the producer, and any organisation which will stabilise prices and at the same time ensure the marketing of eggs only of good quality will be doing a common good. We hope that poultry keepers will come forward with the necessary financial assistance to enable the egg circle to come into being. Full particulars can be obtained by writing to the acting secretary, Box 387, Salisbury.

Tobacco Yields.—A recent bulletin issued by the International Institute of Agriculture, Rome, gives some interesting figures of the yields of tobacco in various countries. We tabulate instances in which the figures are complete:—

Country.	Quantity. lbs.	Acreage.	Yield per acre. lbs.	Year.
United States of America ...	1,117,680,000	1,473,000	758.7	1921
Japan	113,360,000	75,700	1,497.5	1920
Philippines	108,650,000	249,900	434.7	1920
Bulgaria	87,040,000	98,500	883.6	1921
Greece	68,500,000	86,500	792	1920
France	38,910,000	32,000	1,216	1921
Roumania	37,700,000	54,600	690	1919
Italy	36,550,000	56,900	642.3	1921
Algeria	30,930,000	46,500	665.1	1921
Belgium	12,310,000	6,900	1,784	1921
Canada	48,090,000	53,100	905.6	1920

Russia was at one time a large producer of tobacco, for in 1915 the crop totalled 212,910,000 lbs., grown on 141,700 acres, an average of 1,502 lbs. per acre. Russia in Asia in 1915 also grew 31,180,000 lbs. on 41,100 acres, averaging 758.6 lbs. per acre. In Southern Rhodesia our crop of Virginia tobacco in the season 1920-21 was 3,192,662 lbs., grown on 7,888 acres, an average of 404.7 lbs. per acre.

Rhodesian Maize Successes at Johannesburg.—Exhibitors of Rhodesian maize at the Rand Show again figured prominently in the prize list and worthily upheld the reputation gained at previous Shows. Although the Grand Championship in the 500 ear class does not this year come to Rhodesia, an exhibitor from this Territory, Mr. D. W. Bean, was placed second in this event, while he secured the Grand Championship for the best 200 ears. It will be remembered that Mr. Bean won premier honours at the Rand Show last year with 500 ears of Salisbury White maize, while the Grand Championship in 1920 went to Messrs. Glanfield & Rattray, of Bindura. The latter won the Grand Championship at the recent Salisbury Show with a remarkably fine exhibit of 300 ears 8-row Hickory King, Mr. D. W. Bean being placed second. Messrs. Glanfield & Rattray did not exhibit at Johannesburg this year. Although at the time of writing the official announcement has not been made, there is good reason for believing that Mr. D. W. Bean is the winner of the Sam Hyde cup for scoring the highest number of points with any one breed of maize, and the Kleinenberg cup. Mr. Bean, it will be remembered, won these cups last year. The following is a list of the awards gained by Rhodesian exhibitors so far as we have been able to ascertain:—

D. W. Bean, Shamva.

Salisbury White—Low Veld.

500 ears—Runner-up, Championship, and 1st in class.

200 ears—Grand championship and 1st in class.

10 cobs—1st in class.

1 cob—1st in class.

10 bags—Championship and 1st.

E. S. White, Concession.

Hickory King—High Veld.

500 ears—1st in class.

10 ears 8-row—1st in class.

10 ears 10-row—1st in class.

E. S. White, Concession.

High Veld.

10 ears 12-row Texas—1st in class.

1 ear (single cob) 10-row Louisiana Hickory—1st in class.

1 ear 12-row Texas—3rd in class.

H. N. Huntly, Bindura.

Low Veld.

10 ears 8-row Hickory—1st in class.

1 ear 8-row Hickory—1st in class.

H. Kneiser, Lomagundi.

Low Veld.

10 bags shelled maize, 8-row Hickory—1st and championship.

500 ears 8-row Hickory King—2nd in class.

500 ears Louisiana Hickory—3rd in class.

10 ears 10-row Louisiana Hickory—2nd in class.

10 ears Texas—2nd in class.

1 ear 8-row Hickory King—3rd in class.

1 ear 10-row Louisiana Hickory—2nd in class.

SOUTHERN RHODESIA.

Farming Returns for Income Tax Purposes.

(Under Ordinance No. 20 of 1918, as amended by Ordinances Nos. 6 of 1920, 19 of 1921 and 12 of 1922.)

An attempt is made in this pamphlet to explain the principles governing the assessment of farmers' incomes, and the records necessary to enable them to complete satisfactorily the form I.T. 2 (farming return).

Attention is directed to section 35 (1) of Ordinance 20 of 1918, which reads as follows:—

“35. (1) The Commissioner shall annually give public notice in the prescribed manner that all persons liable to taxation personally, or in any representative capacity, under the provisions of this Ordinance, are required to furnish within thirty days after the date of such notice, or within such further time as the Commissioner may for good cause allow, returns for the assessment of the tax. Such notice shall state the places at which the prescribed forms may be obtained, and it shall be the duty of all such persons, and of all persons required by this Ordinance to furnish such returns, to apply for the prescribed forms of returns. Any such person failing to furnish such return shall not be relieved from any penalty by reason only of his having received no notice to furnish the same, or of the prescribed form not having been delivered to him, but the Commissioner may, if he deem it so advisable, cause forms to be delivered or sent by post to any person.”

Farmers who have had no settled basis of return of live stock in the past should advise the Commissioner, when sending in their next returns, as to which basis they wish to adopt. For convenience, this should be clearly stated on Schedule B of form I.T. 2.

1. It is found in this, as in other countries, that considerable difficulty is experienced by the majority of farmers in preparing their income tax returns owing to their transactions not being recorded so regularly and completely as the transactions of other businesses.

2. Farmers should make a practice of counting their live stock at frequent intervals (for instance, on certain dipping days) and recording the results; they should also make regular entries in their diaries of all births and deaths of animals, and in their cash book or journal of all purchases and sales of live stock, sales of produce and any other income, also all expenditure, including wages, which should be allocated every month to—

- (a) **Capital Expenditure**, such as buildings, fencing, dams, wells, boreholes, stumping, machinery, implements, harness, etc.;
- (b) **Working Expenditure**, such as maintenance of live stock and growth of crops, including repairs (but not improvements and additions) to farm buildings (except homestead), fencing, dams, wells, machinery, implements, harness, etc.; and
- (c) **Domestic and Personal Expenditure**, such as living expenses, wages and keep of house boys, clothing, school fees, medical attention to themselves and family, life insurance, etc.

3. Farmers must account for their live stock on hand at the end of each year in the same way as merchants account for their stock on hand, except that they must bring to account in addition the increase caused by births and growth towards maturity, less deaths. The value at which such increase and deaths must be accounted for is explained in the following pages.

4. Although farmers have not realised the above-mentioned increase for cash, it has nevertheless accrued to them by the fact that their herd has increased in value owing to such births and growth.

5. It is not generally understood by farmers that the return of live stock each year for income tax purposes is to their eventual advantage; the tax is equalised over a period of years, instead of being charged as on a cash basis in one, probably, large amount.

6. Pedigree animals and animals of special value must be returned individually, those purchased at their purchase cost, and those bred by the farmer at a fixed standard value representing a portion of the maintenance cost chargeable against this class of live stock.

7. Live stock which is not of special value may be valued on

- (a) cost basis; or
- (b) fixed standard basis.

Under (a) the cost of the herd at the commencing date of the first return is estimated if it cannot be ascertained, all subsequent purchases are entered at cost, and maintenance charges are allocated to the extent of 10s. or £1 each to the calves born during and living at the end of the year, and the balance to the remainder of the herd. When adult animals are sold, the profit is ascertained by deducting the average cost of the adults at the beginning of the year, multiplied by the number of animals sold, from the total proceeds of the sale. If calves are sold, the profit is the difference between the selling price and either 10s. or £1 per head (whichever has been adopted for stock-taking purposes). Deaths are allowed for at the average cost as above.

8. This system (a) is found convenient by many, because it saves the owner from the obligation to pay income tax upon any of the annual increased value of his herd until sales are effected; but owing to the fact that the value of the natural increase is greater in proportion than the maintenance charges, the average cost value of the herd decreases considerably after a period of years. This may lead to accumulated and high profits, resulting in a higher rate of tax on the whole taxable amount than if the farmer had paid tax annually on the accruing profit.

9. Under (b) all purchases, irrespective of their cost, are taken into stock for income tax purposes at fixed standard values. All calves born during and living at the end of the year are also taken into account at fixed standard values (usually) of £1 each. The taxable income is ascertained by taking the proceeds of animals which have been sold during the year and deducting therefrom their fixed standard value, then adding or deducting any difference between the actual cost of animals purchased and the fixed standard value thereof; also adding the standard value of calves born during and living at the end of the year, and the value of any increase by growth through the transfer of calves to adult stock; and deducting deaths at fixed standard value, and also deducting the maintenance charges.

10. A farmer who can afford to pay income tax on the natural increase and growth in value of his herd will find it to his advantage to adopt a moderate fixed standard value (averaging as near as possible the cost of his herd at the date the fixed standard value is adopted), because he will probably pay tax thereon at a lower rate on a comparatively small income annually than he would have to pay on a larger income if he adopted the "cost" basis and only sold animals at long intervals. If, however, a farmer adopted a fixed standard value which is too much below the original cost of his herd and below the price he anticipates to pay for a similar class of live stock, he might easily be much worse off as regards the rate of tax than if he had adopted the "cost" basis. Similarly, if he adopted a fixed standard value which is too high, he might be in an even more disadvantageous position, because he would have paid income tax on (presumed) accruing profits which may never be realised.

11. The following example shows the effect of the "cost" basis and of the three fixed standard bases referred to above when applied respectively to an assumed set of transactions. It will be seen that under the "cost" system the owner would have to be assessed on a taxable income of £862 in the fifth year and £2,663 in the tenth year, making a total of £3,525; under the fixed standard value system with value taken at £5 he would be assessed on a profit every year except the first and ninth—the total coming to exactly the same; under the fixed standard value system with value at £3 he would be assessed for less profit in the fifth year and more in the tenth year than under the "cost" system, but for a total of the same amount; under the fixed standard value system with a valuation of £8 for adults and £2 for calves, he would have to pay tax upon £1,110 more than his actual profit as ascertained upon liquidation in the tenth year.

12. Produce must be returned at the beginning and end of the accounting year at the cost of same to the farmer, that is, the portion of the total working expenditure rightly chargeable to crops, which, it is suggested, should be analysed every month against the two crops (i.e., the crop sold in the year of return and the crop unrepaid at the end of the year of return).

13. That the form I.T. 2 may be properly understood, the following examples with notes are given; all the amounts shown are, of course, imaginary.

EXAMPLE 1.

COUNT OF LIVE STOCK for year ended.....

On hand at beginning of year.		Increases and decreases during year (numbers only).						On hand at end of year. Number.
Description.	No.	Purchased.	Total.	Sold.	Died.	Net total.	Transferred and born and living at end of year.	
Breeding stock of special value (details on separate list) ...	20	5	25	3	2	20	7	27
Cattle ...	500	72	572	104	21	447	59	606
Calves ...	65	...	65	...	6	59	84	84
Sheep ...	80	...	80	35	4	41	20	61
Lambs ...	30	...	30	...	10	20	42	42
Goats ...	...	...	...	...	...	...	...	...
Kids ...	...	...	...	...	...	...	...	...
Horses ...	4	...	4	...	...	4	...	4
Foals ...	...	...	...	...	...	...	...	...
Mules ...	8	2	10	...	2	8	...	8
Donkeys ...	10	6	16	...	2	14	1	15
Foals ...	2	...	2	...	1	1	3	3
Pigs ...	24	3	27	22	2	3	16	19
Totals ...	743	88	831	164	50	617	152 born	769

Note.—Number on hand at beginning of year to be recorded on Schedule B (live stock) at 1st April (or beginning of farmer's accounting year, if it differs from that date).

Number on hand at end of year to be recorded on Schedule B (live stock) at 31st March (or end of farmer's accounting year, if it differs from that date). Calves, lambs and donkey foals of previous year, brought forward at beginning of current year, are transferred to adult stock, as shown above in "transferred and born and living at end of year" column.

"Cattle" may be divided, should it be desired, into "cows," "heifers," "oxen" and "steers."

Example showing difference between the Annual Taxable Income (profit) over a period of ten years resulting from the adoption of the cost basis and fixed standard values.

Taxable income at end of	ON BASIS OF COST.		Farmer has on hand at beginning of first year 500 head, costing £5 each, and has the following purchases, births, maintenance charges, sales and deaths each year.	ON BASIS OF FIXED STANDARD VALUES.					
	Result.	Taxable income.		£5 and £1 for calves.		£3 and £1 for calves.		£8 and £2 for calves.	
				Result.	Taxable income.	Result.	Taxable income.	Result.	Taxable income.
1st year	Loss £85 ...	...	Purchases 25 at £7 each, 100 births, maintenance charges £150, no sales, 25 deaths (12 calves, 13 others)	Loss £177	...	Loss £1,201...	...	Profit £1,447	£1,447
2nd year	Loss £78 ...	...	Purchases 25 at £4 each, 125 births, maintenance charges £200, no sales, 30 deaths (15 each)	Profit £212	£35	Profit £16 ...	...	Profit £528 ...	£528
3rd year	Loss £47 ...	...	No purchases, 150 births, maintenance charges £200, no sales, 20 deaths (10 each)	Profit £330	£330	Profit £130 .	...	Profit £660 ...	£660
4th year	Loss £84 ...	...	Purchases 10 at £8 each, 80 births, maintenance charges £300, no sales, 40 deaths (20 each)	Profit £210	£210	Loss £50 ...	...	Profit £520 ...	£520
5th year	Profit £1,136	£862	No purchases, 150 births, maintenance charges £350, sales 300 at £3 each, 35 deaths (18 calves, 17 others)	Profit £837	£837	Profit £1,351	£ 46	Profit £138 ...	£138
6th year	Loss £103 ...	...	Purchases 20 at £10 each, 200 births, maintenance charges £350, sales 25 at £4 each, 50 deaths (25 each)	Profit £103	£103	Loss £101 ...	...	Profit £452 ...	£452
7th year	Loss £143 ...	...	Purchases 50 at £5 each, 200 births, maintenance charges £400, sales 50 at £3 each, 50 deaths (25 each)	Profit £250	£250	Loss £50 ...	...	Profit £700 ...	£700
8th year	Loss £130 ...	...	No purchases, 100 births, maintenance charges £500, sales 40 at £4 each, 80 deaths (40 each).	Profit £20	£20	Loss £170 ...	...	Profit £190 ...	£190
9th year	Loss £72 ...	...	Purchases 100 at £3 each, 200 births, maintenance charges £400, sales 100 at £5 each, 50 deaths (25 each).	Loss £410	...	Loss £480 ...	...	Loss £190 ...	...
10th year	Profit £3,111	£2,663	No purchases, 225 births, maintenance charges £350, sales (total herd) 1,325 for £7,500, 40 deaths (20 each).	Profit £2,150	£1,740	Profit £4,080	£3,279	Loss £920 ...	...
Total	...	£3,525	...	..	£3,525	.	£3,525	...	£4,635

Note.—No calves included in purchases and sales. Gross births are shown above. All deaths of calves are taken as occurring during year of birth.

Tax paid in excess on 8th year's income of £190	
" " 7th	700
" " 6th	220
	— £1,110
	£3,525

EXAMPLE 2.**RECEIPTS.**

(Page 2 of form I.T. 2.)

	£
1. 3 pedigree animals—Marsh George, £60; Marsh Clinker, £35; Marsh Cowboy (calf), £30	125
104 cattle	720
(If calves are sold, these should be shown separately.)	
35 sheep	40
22 pigs	90
2. 1,000 bags mealies	900
50 bags potatoes	65
3. J. Brown, "Cutfield," P.B., Salisbury, grazing	25
4.	nil
5.	nil
(If any, state whether net or gross amount returned; if gross amount is returned, expenditure incidental thereto and allowable as a deduction should be shown on page 3 of form I.T. 2 amongst outgoings.)	
6.	nil
7.	50
8.	nil
Total	£2,015

EXAMPLE 3.**EXPENDITURE (Outgoings).**

(Page 3 of form I.T. 2.)

	£
1. 5 pedigree animals—King's Lad, £125; Ruby Red, £60; Ruby Gorse, £40; Ruby Lily, £42; King's Orphan (yearling), £200	500
72 cattle	310
(If calves are purchased, these should be shown separately).	
2 mules, £60; 6 donkeys, £30	90
3 pigs	6
	<hr/> 708
2.	nil
(If any, rent of farm or grazing to be returned for current year only.)	
3. Land Bank, 7 per cent., £800	56
(Not to include back interest nor repayment of loans.)	
4.	3
(For current year only; not to include any quitrent on farms that are not being worked or grazed.)	
5. Mealies, £30; fertiliser, £40	70
(Only that purchased in current year; the cost of seed grown by the farmer is included in wages, etc., and must not be returned again under this heading.)	
6. Bran, linseed and green fodder	120
(Remarks against No. 5 apply to this heading.)	
7. Native, £240; white, £120; board for white man (say) £60	420
(Representing the portion applying to working expenditure; see paragraph 2.)	
8.	nil
(Remarks against No. 5 apply to this heading.)	
9.	75
(See notes on "wear and tear," paragraph 12.)	
10. 1,200 grain bags, £120; insurance, £12; hired transport for produce to station, £56; motor car expenses, £40; sundries, £20	248
(Give full details under this heading; not to include insurance or maintenance of dwelling house, nor own transport—the expenses of which are included in wages, etc.)	
(Motor car expenses—the portion, if any, incidental to the working of the farm only should be returned.)	
Total	<hr/> £1,700

EXAMPLE 4.

ALLOCATION OF EXPENDITURE as shown on Example 3.

(Foot of page 3 of form I.T. 2.)

(For use when working on Cost Basis.)

	£
1. Live stock purchased	708
2. Expenditure during year in production of produce sold and other income	286
3. Expenditure during year in production of produce on hand and unreaped at 31st March	396
4. Expenditure during year on maintenance of live stock ...	310
	£1,700

Note.—When working on fixed standard values, no allocation is required except the proportion of expenditure relative to produce on hand and unreaped at 31st March.

EXAMPLE 5 (A).

PEDIGREE AND PURE BRED CATTLE RETURN for year ended.....

On hand at beginning of period.				Sold and died during period.			Remarks— at end of year.
Breed and class.	Name.	Pedigree number.	Cost or fixed standard value.	Date sold.	Sale price.	Date died.	
<i>Devon.</i>			£		£		
Bull ...	Marsh Bobbie ...	6285	100	...	...	...	On hand
do ...	Marsh Prince ...	6841	100	...	...	...	do
do ...	Marsh George ...	6563	100	13th May	60	...	Sold
Cow ...	Marsh Gertie ...	6122	80	...	...	12th Aug.	Died
do ...	Marsh Esmay ...	6474	75	...	...	...	On hand
do ...	Marsh Bridget ...	6839	70	...	...	...	do
do ...	Marsh Ethel ...	6105	80	...	...	...	do
do ...	Marsh Edith ...	6329	60	...	...	...	do
do ...	Marsh Lilian ...	6678	55	...	...	...	do
do ...	Marsh Kate ...	6814	65	...	...	...	do
do ...	Marsh May ...	6392	45	...	...	...	do
Heifer	Marsh Nora ...	522	25	...	...	...	do
yearling							Now
do ...	Marsh Megg ...	526	25	...	...	4th Dec.	2-year heifer
do ...	Marsh Mary ...	532	25	...	...	...	Died
							On hand. Now
Bull	Marsh Clinker ...	622	25	20th July	35	...	2-year heifer
yearling							Sold
do ...	Marsh Almond ...	630	25	...	...	...	On hand. Now
Bull calf	Marsh Boxer ...	836	10	...	...	...	2-year bull
do ...	Marsh Cowboy ...	841	10	20th July	30	...	On hand. Now
Heifer calf	Marsh Olive ...	842	10	...	...	...	yearling at £25
do ...	Marsh Pat ...	865	10	...	...	...	Sold
							On hand. Now
							yearling at £25
							do do
		20	995	3	125	2	15 on hand

EXAMPLE 5 (B).

Purchased during period.				Sold and died during period.			Remarks— at end of year.
Breed and class.	Name.	Pedigree number.	Cost.	Date sold.	Sale price.	Datedied.	
<i>Devon.</i>			£				
Bull	King's Lad ...	6242	125	...	...	...	On hand.
Bull, yearling	King's Orphan	615	35	...	...	...	do
Cow	Ruby Red ...	6826	60	...	...	...	do
do	Ruby Gorse ...	6854	40	...	...	...	do
do	Ruby Lily ...	6906	42	...	...	...	do
		5	302				5 on hand.

EXAMPLE 5 (C).

Born during period.				Sold and died during period.			Remarks— at end of year.
Breed and class.	Name.	Pedigree number.	Fixed standard value.	Date sold.	Sale price.	Datedied.	
<i>Devon.</i>			£				
Bull calf ...	Marsh Gay Lad...	...	10	...	..	...	On hand.
do ...	Marsh Gentleman	...	10	...	...	...	do
do ...	Marsh Rover ..	...	10	...	...	...	do
Heifer calf ...	Marsh Emma ...	...	10	...	...	...	do
do ...	Marsh Jean ...	...	10	...	...	...	do
do ...	Marsh Jess ...	...	10	...	...	...	do
do ...	Marsh Betty ..	...	10	...	...	...	do
		7	70				7 on hand.

EXAMPLE 6.**SCHEDULE B (Live Stock).**

(Page 4 of form I.T. 2.)

Columns ...	COST BASIS.				FIXED STANDARD BASIS.	
	A.		B.		C.	D.
Description.	1st April.		31st March.		1st April.	31st March.
	No.	Cost.	No.	Cost.	Fixed standard value.	Fixed standard value.
Breeding stock of special value, to be detailed in list to be attached ...	20	£ 995	27	£ 1,172	£ 995	£ 1,172
Other stock :—						
Cattle ...	500	2,260	506	2,140	2,500	2,530
Calves ...	65	65	84	84	65	84
Sheep ...	80	65	61	44	80	61
Lambs ...	30	7	42	10	7	10
Goats ...	...	...	...	...	...	...
Kids ...	...	...	...	...	...	...
Horses ...	4	110	4	110	100	100
Foals ...	...	...	...	...	...	...
Mules ...	8	185	8	199	200	200
Donkeys ...	10	54	15	72	30	45
Donkey foulds ...	2	1	3	2	1	2
Ostriches ...	...	...	...	...	...	...
Ostrich chicks ...	...	...	...	...	...	...
Pigs ...	24	49	19	27	24	19
Other stock (specify) :						
Total values ...		£3,791		£3,860	£4,002	£4,223

Note.—Columns A and C.—The numbers and amounts are taken from Schedule B, columns B or D (31st March) of the previous year's return. If no return has been sent in previously, the numbers stated should be those on hand at that date, and the amounts against each class should be (a) approximate cost at that date (*i.e.*, purchase cost of any purchased plus a proportion of the annual working expenditure for maintenance cost to that date), or (b) the fixed standard values, if this method has been adopted.

Columns B and D.—The numbers are taken from the count of live stock (Example 1) at the end of the year. The amounts returned in column B are arrived at as follows:—

<i>Breeding Stock of Special Value—</i>	No.	£
On hand at 1st April	20	995 cost and fixed std. val.
Purchased during year	5	302 cost.
Born during year (and living at end of year)	7	70 fixed std. value.*
	<u>32</u>	<u>1,367</u>
Sold during year	3	135 cost and fixed std. val.
	<u>29</u>	<u>1,232</u>
Died during year	2	105 cost and fixed std. val.
	<u>27</u>	<u>1,127</u>
Increase by growth in fixed standard value—		
3 calves at £10 to yearlings at £25 ...		45 fixed std. value.*
On hand 31st March ...	27	£1,172

*Equivalent to maintenance charge.

<i>Cattle and Calves—</i>	No.	£
On hand 1st April—Cattle ...	500	2,260 = £4 10s. 5d. per head.
Calves ...	65	65 = £1 per head.
	<u>565</u>	<u>2,325</u>
Purchased during year	72	310 cost.
Born during year (and living at end of year)	84	160 maintenance charge.
	<u>721</u>	<u>2,795</u>
Sold during year (adults only)	104	470 average cost of adult herd at beginning of year, i.e., £4 10s. 5d. per head.
	<u>617</u>	<u>2,325</u>
Died during year—		
	No.	£
Cattle	21	95
Calves	6	6
	<u>27</u>	<u>101</u> average cost at begin- ning of year.
On hand 31st March	590	£2,224
		£
506 cattle	2,140	
84 calves	84	
	<u>590</u>	<u>£2,224</u>

<i>Sheep and Lambs—</i>		No.	£
On hand 1st April—Sheep ...	80	65 = 16s. 3d. per head.	
Lambs ...	30	7 = 5s. per head.	
	—	—	
	110	72	
Born during year (and living at end of year)	42	15 maintenance charge.	
	—	—	
	152	87	
Sold during year (sheep only)	35	28 average cost as above (16s. 3d.).	
	—	—	
	117	59	
Died during year—			
	No.	£	
Sheep	4	3	
Lambs	10	2	
	—	—	
	14	5 average cost as above.	
On hand 31st March	103	£54	
	£		
61 sheep	44		
42 lambs	10		
	—	—	
103	£54		

*Horses—*No change.

<i>Mules—</i>		No.	£
On hand 1st April	8	185 = £23 2s. 6d. per head.	
Purchased during year	2	60 cost.	
	—	—	
	10	245	
Died during year	2	46 average cost as above.	
	—	—	
On hand 31st March	8	£199	

No maintenance charge is allocated against mules.

<i>Donkeys—</i>		No.	£
On hand 1st April—Donkeys ...	10	54 = £5 8s. per head.	
Foals	2	1 = 10s. per head.	
	—	—	
	12	55	
Purchased during year	6	30 cost.	
Born during year (and living at end of year)	3		
	—	—	
	21	85	
Died during year—			
	No.	£ s. d.	
Donkeys	2	10 16 0	
Foals	1	0 10 0	
	—	—	
	3	11 average cost as above.	
On hand 31st March	18	£74	

	£	s.	d.
15 donkeys	72	10	0
3 foals	1	10	0
18	£74	0	0

No maintenance charge is allocated against donkeys.

<i>Pigs—</i>	No.	£
On hand 1st April	24	49 = £2 per head.
Purchased during year	3	6 cost.
Born during year (and living at end of year)	16	20 maintenance charge.
	43	75
Sold during year	22	44 average cost as above
	21	31
Died during year	2	4 average cost as above.
On hand 31st March	19	£27

Total maintenance charges for live stock, £310.

The amounts returned in column D are arrived at as follows:—

	No.	£	s.	d.
Breeding stock of special value—				
(same as under cost basis)	27	1,172	0	0
Cattle at £5	506	2,530	0	0
Calves at £1	84	84	0	0
Sheep at £1	61	61	0	0
Lambs at 5s.	42	10	10	0
Horses at £25	4	100	0	0
Mules at £25	8	200	0	0
Donkeys at £3	15	45	0	0
Foals at 10s.	3	1	10	0
Pigs at £1	19	19	0	0

Similar values as returned at 1st April.

EXAMPLE 7.**SCHEDULE B (Produce).**

(Page 4 of form I.T. 2.)

Description.	E.		F.	
	Columns			
	1st April.		31st March.	
	Quantity.	Cost value.	Quantity.	Cost value.
Wool ... ..	...	...	...	...
Mohair ... ..	...	...	...	...
Ostrich feathers ..	...	...	...	...
Tobacco ... ..	...	...	...	...
Wheat, bags of 203 lbs.	...	...	...	...
Mealies, bags of 203 lbs.	1,000	£250	1,500	£375
Oats, bags of 150 lbs.	...	...	...	...
Barley, bags of 150 lbs.	...	...	...	...
Rye, bags of 203 lbs.	...	...	...	...
Oat hay, bales of 150-200 lbs.	...	...	...	...
Potatoes, bags of 153 lbs.	...	...	...	...
Grass hay, bales ...	...	...	...	21
Other produce (specify):				
Total values		£250		£396

Note.—Column E.—The quantities and amounts are taken from Schedule B, column F (31st March), of the previous year's return. If no return has been sent in previously, the quantity stated should be that on hand and unreaped at that date; the amount against each item should be approximate cost at that date, *i.e.*, proportion of previous year's working expenditure relative to such produce on hand and unreaped.

Column F.—The quantities to be returned in this column are those actually on hand and approximate quantity of produce unreaped at that date. The amounts against each item should represent approximate cost, *i.e.*, proportion of working expenditure relative thereto, as shown on Example 4.

EXAMPLE 8.**SUMMARY OF AMOUNTS** returned on Schedule B.

(Foot of page 4 of form I.T. 2.)

	Cost Basis.		Fixed
	£		Standard Basis.
	£		£
Live stock, 1st April	3,791		4,002
Produce, 1st April	250		250
	—	4,041	—
			4,252
Live stock, 31st March	3,860		4,223
Produce, 31st March	396		396
	—	4,256	—
			4,619
Difference (increase) in live stock and produce on hand, 1st April and 31st March (to be carried to summary on foot of page 2 of form I.T. 2).	£215		£367

(See Example 9.)

EXAMPLE 9.**FINAL SUMMARY.**

(Foot of page 2 of form I.T. 2.)

	Cost Basis.	Fixed
	£	Standard Basis.
	£	£
Receipts	2,015	2,015
Expenditure	1,700	1,700
	—	—
Balance	315	315
Add increase in live stock and pro- duce on hand, 31st March	215	367
	—	—
Profit for year	£530	£682

(To be carried to paragraph 1
under business of farming on
form I.T. 1.)

Note.—The profit made on the "cost" method of return as shown above is arrived at as follows:—

	£	£	£
Profit on receipts (Example 2)			
Cattle proceeds (Example 2)	720		
Less cost (Example 6)	470		
	—		
		profit	250
Sheep proceeds (Example 2)	40		
Less cost (Example 6)	28		
	—		
		profit	12
Pigs proceeds (Example 2)	90		
Less cost (Example 6)	44		
	—		
		profit	46

Mealies and potatoes proceeds (Example 2)	965		
Grazing (Example 2)	25		
Live stock and produce used for domestic purposes (Example 2)	50		
	—	1,040	
Less expenditure of previous year re- lative to crops brought forward at 1st April (Example 7)	250		
Less cost during current year (Example 4)	286		
	—	536	
		—	profit 504
			812
Less loss on—			
Pedigree Cattle—			
Cost (Example 6)	135		
Less proceeds (Example 2)	125		
	—	loss 10	
Less Deaths—			
Pedigree cattle (Example 6) ...		105	
Cattle and calves (Example 6)		101	
Sheep (Example 6)		5	
Mules (Example 6)		46	
Donkeys (Example 6)		11	
Pigs (Example 6)		4	
		—	loss 282
			—
			Profit as above ... £530

And the profit made on the fixed standard method of return as shown above is arrived at as follows:—

	£	£
Profit on receipts (Example 2)		
Cattle proceeds (Example 2)	720	
Less fixed standard value, 104 at £5	520	
	—	profit 200
Sheep proceeds (Example 2)	40	
Less fixed standard value, 35 at £1	35	
	—	profit 5
Pigs proceeds (Example 2)	90	
Less fixed standard value, 22 at £1	22	
	—	profit 68
Mealies, potatoes, grazing and live stock and produce used for domestic purposes (same as under "cost" method)		profit 504
		—
		777
Less loss on sale pedigree cattle (same as under "cost" method)		10
		—
		£767

	£	£	s.	d.
Add difference ("profit") on purchases—				
Cattle purchased (Example 7)	310			
Fixed std. value, 72 at £5 ...	360			
			profit	50
Mules purchased (Example 7)	60			
Fixed std. value, 2 at £25 ...	50			
		loss	10	
Donkeys purchased (Example 7)	30			
Fixed std. value, 3 at £6 ...	18			
		loss	12	
Pigs purchased (Example 7)	6			
Fixed std. value, 3 at £1 ...	3			
		loss	3	
				25
				25
Add births at fixed std. values—				
84 calves at £1 (Example 1) ...		£	s.	d.
42 lambs at 5s. (Example 1) ...		84	0	0
3 donkey foals at 10s. (Example 1) ...		10	10	0
16 pigs at £1 (Example 1) ...		1	10	0
		16	0	0
				112
Add increase in growth by transfer to adult stock—				
59 calves to cattle at £4 (Example 1) ...		£		
20 lambs to sheep at 15s. (Example 1) ...		236		
1 donkey foal to donkeys at £2 10s. (Example 1)		15		
		3		
				254
				1,158
Less deaths at fixed std. values—				
Pedigree cattle (same as under "cost" method)		105		
21 cattle at £5 (Example 1) ...		105		
6 calves at £1 (Example 1) ...		6		
4 sheep at £1 (Example 1) ...		4		
10 lambs at 5s. (Example 1) ...		2		
2 mules at £25 (Example 1) ...		50		
2 donkeys at £3 (Example 1) ...		6		
1 donkey foal at 10s. (Example 1) ...		1		
2 pigs at £1 (Example 1) ...		2		
				281
				£877
Less maintenance charges (Example 6)—				
Cattle ...		160		
Sheep ...		15		
Pigs ...		20		
				195
				Profit as above ...
				£682

14. The allowance for "wear and tear" of machinery, implements, vehicles and windmills is a provision for the diminished value caused by actual use during the year of assessment, which has not been made good by repairs or replacements.

15. Up to 10 per cent. of the *decreasing* amount is allowed for "wear and tear," and the following example shows how the amount for calculating the 10 per cent. is arrived at:—

	£
Machinery, implements, etc., on hand at (say) 1st April, 1919	500
Purchased during year ended 31st March, 1920	250
	<hr/>
	£750
10 per cent. allowed for year ended 31st March, 1920 ...	75
	<hr/>
Which decreases the amount to	£675
Add during year ended 31st March, 1921, purchase of new parts for wagon, £100, less sale of discarded implements, £20, a net addition of	80
	<hr/>
Making the amount for calculation	£755
10 per cent. allowed for year ended 31st March, 1921	75
	<hr/>
Decreased amount	£680
No purchases or sales during the year ended 31st March, 1922.	
10 per cent. allowed	68
	<hr/>
Decreased amount to carry forward at 1st April, 1922	£612
(To which must be added any purchases, and from which must be deducted any sales, during the year ending 31st March, 1923, to arrive at the amount for calculation for that year.)	

16. Repairs, if considered reasonable by the Commissioner, are allowed in addition to the above allowance for "wear and tear," but the allowance for repairs is taken into consideration when making the allowance for "wear and tear."

17. Purchases and sales of machinery, implements, etc., must not be shown on the I.T. 2 return. Any profit on sale of such is not chargeable with income tax, neither is any loss on sale allowed as a set-off against income. The cost of replacement of tools is allowed. Repairs to buildings (other than homestead), dams, fencing, wells and boreholes are allowed, but depreciation of such is not allowed.

18. Fixed values must be adhered to, except in cases where satisfactory evidence can be brought before the Commissioner showing that the original fixed values were above actual average cost or where the average cost has been decreased through subsequent purchases, and then only may the values be reduced upon written application to and with the consent of the Commissioner. The farmer's application will be considered only subject to his (the farmer's) acceptance of liability for any tax which may become due for past years owing to the alteration.

19. Fixed standard values may be adopted for the various classes of cattle, such as cows, heifers, oxen and steers, if desired, but in such cases lists giving details must be furnished each year to confirm that the values have been adhered to.

20. No depreciation is allowed on live stock and produce.

21. Seed, fertilisers and feeding stuffs purchased during but on hand at the end of the farmer's accounting year should be shown as on hand on Schedule B, together with other produce.

22. As the cost of produce and seed grown by a farmer is included in his wages and other expenditure, it must not be returned again by him as "feed," seed, etc.

23. When any particular expenditure, such as wages, etc., has increased considerably in any year, full explanation as to the reason of the increase should be given.

24. When a farmer has an interest in crops other than those of his own growing, full particulars of this must be shown on page 2 of form I.T. 2.

25. A farmer may suit his own requirements as to the date upon which he closes his accounts, but all returns must be for twelve months, and must follow on each year with the succeeding period of twelve months.

26. Form I.T. 2 is accepted in place of a Trading Account and Profit and Loss Account, but it should always be accompanied by a Balance Sheet showing all the farmer's assets and liabilities.

27. Two I.T. 2 forms are sent to farmers each year—one for return to the Commissioner when completed and the other for retention by the farmer for record purposes. If the completed duplicate forms are kept from year to year, they will enable the farmer to compare his results for the different years.

28. In the case of partners dividing the income from one or more farms, duplicate I.T. 2 forms with the supporting accounts need not be sent, but full reference to the form and accounts must be made by the partners sending only the I.T. 1 form.

29. Farmers with trading stores should keep the accounts of the farm and store separately.

30. Any papers sent to the Commissioner without covering letter should bear the farmer's name and address.

31. "Accounting year" is the farmer's year of return. "Assessment year" is the Government's year ending 31st March.

Chillies in Rhodesia.

By G. H. GORDON, Kashao, Banket Junction.

Having been anxious to find a crop which was proof against baboons, pigs and porcupines, to say nothing of native depredators, I thought of chillies, which I had seen grown many years ago in Nyasaland and Egypt by two friends of mine, and it may perhaps interest some of your readers to know the results.

In 1920 I tried to get seed through Messrs. G. H. Williams & Co., and after some delay they were able to obtain seed from France in sufficient quantity, *i.e.*, 1 lb. Unfortunately this only arrived in December and was sown in seed beds about half an ounce to the square yard in succession, so as to have the plants not all ready at the same time. As this was entirely an experiment, I could only guess what area it would plant out by counting the seeds to half an ounce and allowing 50 per cent. for non-germination and then allow for plants about 15 ins. apart in rows 3 ft. apart. I prepared consequently about four acres by ploughing and harrowing with disc harrow and spike harrow to obtain a fairly good surface, but did not take any very extra special care more than would be required for maize, as I wished to try the crop thoroughly as an ordinary field crop. The soil was an ordinary grey granite which had been under maize for a good many years, and which had produced on the average about three bags per acre. One corner of it was fairly good black soil, and on this the chillies did much better, but the plants suffered more from the dry season. No manure was applied to the land. The situation was subject to slight frosts.

When the plants were about 3 ins. high, which was not till 18th February, they were planted out about 15 ins. apart in rows 3 ft. apart on five successive days whilst it was overcast, usually in the mornings. Eight boys were employed, which represented about three complete days' work for eight boys. The area actually planted was $2\frac{1}{2}$ acres, and this area was hand scuffled twice, which kept it very clean.

The plants did not grow as well as they should, owing to being planted out too late, and only reached to about 1 ft. in height. The fruit began to ripen in May, and picking was actually commenced on 9th June and kept up intermittently, as there seemed to be a decent show of scarlet on the field, enough to employ six or seven

boys at a time. At first I made the boys clean the fruit from the green calyx, but as a good many of them were very dry, this meant a loss of seed and weight, so that later I made them merely remove the stalk.

The chillies were found unfortunately not to have been all of one kind. Some of them were a large variety of capsicums about 1 in. in diameter and 4 ins. long, and the rest $\frac{1}{4}$ in. in diameter and $2\frac{1}{2}$ ins. long. These of course were picked separately, and all were spread on a flat rock to dry, occupying a space of about 20 square yards. As the chillies dried thoroughly, which took about five or six days, they were bagged in new grain bags and pressed in a powerful press, which allowed each bag to hold $\frac{1}{2}$ cwt. The picking went on for about two months, and represented six boys' work for about twelve days.

A sample of each kind was sent Home through the kindness of Messrs. G. H. Williams & Co. for report, and the report given was that the large chillies were worth about 60s. per cwt. and the small ones 70s. The final bagging and pressing was not completed till September, as the bags had to be packed into another bag to make a double thickness, since the small fruits especially worked their way through the single bag.

On 1st October 8 cwts. were railed to Beira *en route* to the Standard Bank of South Africa, Ltd., London, who had kindly offered to dispose of them for me through a broker. In January I received the broker's note showing that there was no difference in the price for those with or without the green calyx, and the prices were much better than anticipated, being 85s. per cwt. for the large chillies and 90s. to 92s. per cwt. for the small.

The actual weights in London did not come up to the 8 cwts., but the price realised came to just over £31. The costs were £2 3s. for railage to Beira, £4 17s. 7d. shipping to London, insurance, dock charges, exchange, etc., about £2 10s., and of course the cost of 30 grain bags and the cultivation and picking, etc., altogether (say) £7, or a total of about £17, leaving a balance in my favour of £16, or very nearly £8 per acre.

It must be remembered, of course, that this was not a fair test, as the seed was received too late.

I collected about 2 lbs. of seed from this crop, keeping the two varieties separate, and sowed seed beds again in October, 1921, hoping to plant out about 8 or 10 acres more, but the season was so unfavourable that I was only able to plant out six acres, and this was practically an entire failure owing to insects (which were uncontrollable last season) eating off the young plants and want of rain to make the survivors grow. However, my original $2\frac{1}{2}$ acres gave me rather more than 8 cwts. this year again without replanting, but as they began ripening during the rains there was considerable difficulty in drying them, and in an ordinary season, when they should begin ripening in December, it would be necessary probably to

dry them on canvas racks in a tobacco barn. It is doubtful also if many of these original plants will survive this season.

There is one thing I should have made clear before, namely, that the crop turned out not to be chillies at all, but capsicums, and I have therefore tried to get the true small African chilli, which is valued at 140s. per cwt., and hope to plant out some of these next season, but fear that the cost of picking will reduce the profit greatly.

It certainly seems to be a profitable crop, but it remains to be seen whether the price will keep up if many go in for it, especially as the cost and trouble of picking cannot be cut down.

I regret that I have no photographs to send you, but if I grow them again next season will certainly try to get some.

Annual Report of Experiments, 1921-22, Experiment Station, Salisbury.

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist.

The season was a most unfavourable one, the rainfall being considerably lighter and less advantageously distributed than in any other year since 1909, when the Station was first opened. As a result, a number of the crops more sensitive to drought or sown late in the season failed entirely, while the yield of all was very considerably reduced. The rainfall in detail was as follows:—

October	2.33 inches in 6 days.
November	2.81 " 6 "
December	4.36 " 12 "
January ... ..	.96 " 3 "
February	4.63 " 11 "
March	1.73 " 6 "
April	Nil.
Total	16.82 inches.

It will be seen that the early planting rains from October to December were sufficiently generous to allow of all crops planted previous to Christmas being got in under satisfactory conditions. The January drought retarded growth, but if good rains had fallen in February would not have seriously reduced the yields. As it was, however, only five useful rains (showers of half an inch or more in any one fall) were registered from the 1st January onwards. These rains were .50, 1.17 and 1.31 on the 1st, 2nd and 3rd February, followed by .57 and .65 respectively on the 8th and 23rd March. The total precipitation was 16.82 ins. compared with 33.4 ins. for the previous year. The effect of the drought was particularly noticeable on crops whose vitality had through any cause been lowered. This is specially reflected in the very low maize yields returned in the variety trials, growers' tests and in other experiments with maize where for the previous two or three years the nature of the work had rendered artificial pollination necessary.

Although the season proved so unfavourable for heavy yields, it may yet, from the experimental point of view, be regarded as beneficial, in that in spite of the drought different methods of soil management

have resulted in marked differences in yield. Where, therefore, it is found that some of these methods appreciably increased the yield in a good season such as that of 1920-21 and likewise in the abnormally bad season now reported upon, it is a fair inference that such treatment may be relied upon with certainty in normal seasons and over any given period of years.

Almost without exception a clearly defined yield increase is noticeable in all maize experiments where the supply of organic matter in the soil has been increased by manuring, by green manuring or by ploughing under a heavy stubble of a preceding crop. Knowing that the presence in the soil of an ample supply of organic matter increases its moisture absorbing and moisture retaining capacity, such a result is not surprising. What is specially worthy of note, however, is that similar beneficial results were equally well shown in the previous season, when the rainfall was ample for all crop requirements.

The annual reports of the Station for the two previous years were published in this *Journal* for February, 1921, and February, 1922, respectively, and were reprinted as bulletins Nos. 382 and 411.

EXPERIMENTS WITH MAIZE.

In all these experiments, unless otherwise stated, the variety grown was Salisbury White, and seed was planted between the 24th and 30th November. On the average all maize crops were cultivated three times and hand-hoed twice. Preparatory cultivation of the land was in all cases the same, viz., once ploughed with mouldboard plough as soon as the previous crop could be got off the land; clod crushed or disc-harrowed within a week or two of ploughing and just prior to seeding worked to a good tilth with disc and drag harrow.

Rotation Experiments.—*Series A.*—Commenced 1913-14. This is the first series of definite rotation experiments laid down in Rhodesia, and since its inception the treatment originally planned has been strictly adhered to. The land was broken up for the first time in 1912. In the season 1912-13 all plots grew wheat except the continuous maize, which grew maize reaped for silage. The results of the years 1913-19 are dealt with in Bulletin No. 342, since which the yields have been reported on in each annual report of the station. It will be noticed that summer wheat and mangels figure in the rotations. When originally planned, it was hoped that wheat might prove a staple summer crop, but events have not justified this optimism. The place of wheat might equally well be taken by oats, Sudan grass, manna or any other annual hay crop. Mangel was included in the four-course since it was the most exhausting crop which could be grown on the manured land, and it therefore follows that if fertility is maintained under this system of cropping, it should even better be maintained if a second crop of maize in the four years took the place of the mangel.

A point of interest this season is that for the first time on record the yield of maize on the alternate maize and bare fallow plot has exceeded the maize yield on the plots cropped every year. The obvious

inference is that the bare fallow the previous season led to greater absorption and retention of moisture and that the following maize crop benefited by this. The lowest previous rainfall recorded was 22.34 ins. for the season 1915-16, and the continuous maize plot then yielded 5.8 bags per acre.

The relative yields—maize calculated to the nearest quarter of a bag—are as follows:—

	Yield per acre, 1921-22.	Yield per acre, 1920-21.	Average yield per acre for previous years.
<i>System of cropping.</i>			
1. Maize continuous with- out manure, 9th year	3.75 bags	13 bags	7.39 bags (8 years)
2. Alternate maize and bare summer fallow	13.25 bags	21.5 bags	12 bags (8 years)
<i>Three-course rotation.</i>			
3. Maize	12.75 bags	21.5 bags	14.8 bags (7 years)
4. Velvet beans* ...	5 bags seed	4 bags seed	1 ton hay (7 years)
5. Wheat	190 pounds	180 pounds	2.3 bags (7 years)
<i>Four-course rotation.</i>			
6. Maize	11.25 bags	35 bags	18 bags (6 years)
7. Wheat	110 pounds	2.4 bags	2.0 bags (6 years)
8. Velvet beans† ...	5 bags seed	1 ton hay	1 ton hay (6 years)
9. Mangels (receive 6 tons dung per acre)	13.25 tons	5 tons	8 tons (6 years)

* From 1913-19 this crop was cut for hay, and only the roots were returned to the land. Since 1920 it has been grown for seed, and after reaping, fallen leaves, vines and roots have been ploughed in.

† The velvet beans on this plot are usually cut for hay. This year, however, they were saved for seed, but all fallen vines and leaves were removed from the land before it was again ploughed.

The high yield of mangels, in spite of the drought, is explained by the stand being the best ever obtained on the station. The 1920-21 stand was exceedingly poor.

Since the primary object with which these experiments were undertaken was to demonstrate the advantages of crop rotation, no regard was paid to the maize yields in the three- and four-course rotations until the effect of the rotation had had time to become apparent. Thus

in the three-course the first maize crop to feel this effect and to be reported upon was that reaped in 1915-16, and in the four-course that reaped in 1916-17. All plots are naturally of the same size, and on estimating the total maize yield from each system of cropping it is found that—

Eight years' crops of maize on the continuous maize plot have yielded	59.17 bags.
Eight crops on the alternate maize and bare fallow have yielded	96.25 bags.
Seven maize crops in the three-course rotation have yielded	99.25 bags.
Six maize crops in the four-course rotation have yielded	108.25 bags.

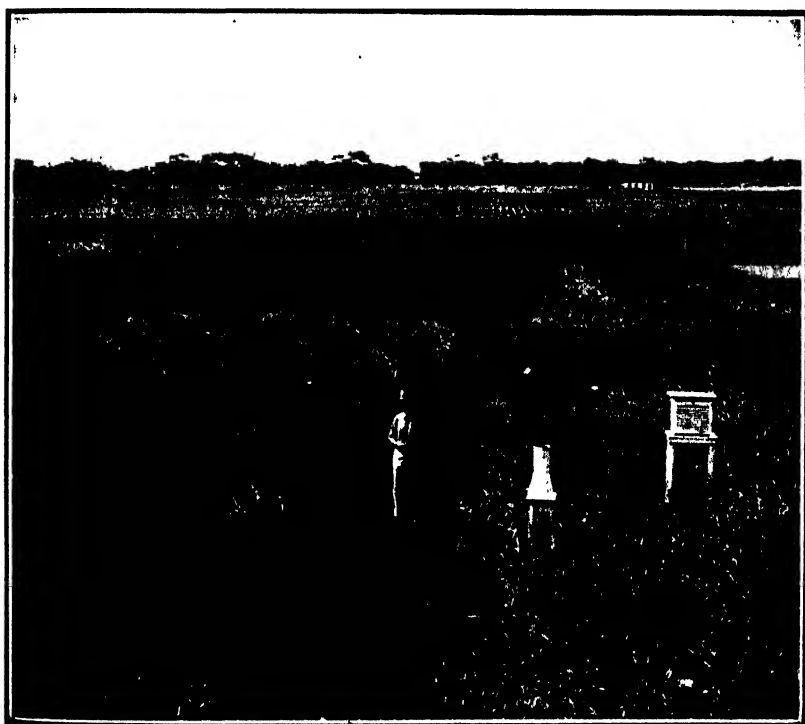
It would be difficult to find more convincing evidence of the increased yields derived from judicious rotation. Land worked under the three and four courses has yielded more than double that returned from land continuously cropped to maize, while in the one case the soil is now worn out and exhausted, and in the other is still capable of producing as good crops as when first brought under the plough. It is of particular interest to note that seven crops of maize in the three-course rotation, in spite of the fact that the land has never received manure, have yielded as great a total weight of grain as eight crops taken from land which is cropped only one year and rested the next year. Still another point which emerges from these experiments, which has been commented upon in a previous report and which has this year revealed itself to many practical farmers on their own farms, is the alarming drop in the yield from exhausted land in an unfavourable season. In a very favourable season such land may yield misleadingly well, and a bad season is required to bring home to the farmer the extent to which such a soil has been impoverished. The more fertile the soil, the better is the crop able to withstand drought or other vicissitudes and *vice versa*.

These primary rotations were laid down to demonstrate the extent to which the old-world lessons regarding crop rotation were applicable to Rhodesia. Having by 1919 served this purpose, a new series was then planned on more practical lines and allowing for three-quarters of the land being annually planted to maize. The results of these for the first three years are shown in the following table, Series B, maize returns in bags per acre.

	Yield per acre, 1921-22.	Yield per acre, 1920-21.	Yield per acre, 1919-20.
<i>System of cropping.</i>			
1. Maize continuous, no manure	13	27.2	25.5
<i>Four-course rotation.</i>			
Land receives 8 tons dung per acre once every four years, and once every four years grows an annual hay crop the stubble of which is ploughed under.			
2. Sudan grass, maize crop received dung 1919-20	3 tons Sudan hay (3 cuttings)	28	26
3. Maize, received dung 1920-21	14.25	26.9	23.7
4. Maize, received dung 1921-22	15.75	28.55	Sudan grass ½ ton hay
5. Maize following Sudan, has not yet received dung	13.75	Sudan hay 1½ tons	24.6
6. Maize continuous, no manure	11.75	24.2	23.3
<i>Four-course rotation.</i>			
Land receives 150 lbs. complete artificials once every four years, and once every four years a velvet bean crop is ploughed under.			
7. Maize, fertilised 1919-20	Green manured	25.9	23.1
8. Maize, fertilised 1920-21	11.75	24.6	23
9. Maize, fertilised 1921-22	12.75	23.7	Green manured
10. Maize, not yet fertilised	14.15	Green manured	19.2

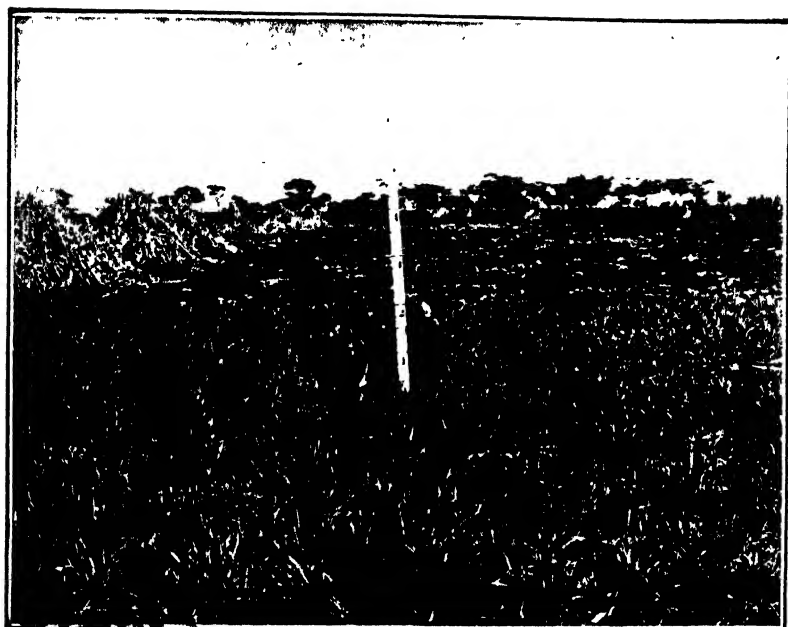
The series of plots on which these experiments are carried out stretch from east to west and were in a high state of fertility when the trials were commenced. As is clearly shown by the three seasons' yields, the natural fertility decreases from east to west. The fact that plot No. 10 on the poorest land and which in 1919-20 gave the lowest yield of any gave this year after being green manured the highest yield of any but two is striking evidence of the value of green manuring.

If the yields for the last two years on the continuous maize plots in Series A and B are compared, it will be seen that whereas the unfavourable season has only reduced the yield from land still in a good state of fertility by approximately 50 per cent., the yield on the exhausted land in Series A has been reduced by nearly 200 per cent. The relative benefits derived from an application of dung, from the ploughing under of a grass stubble and from green manuring are not difficult to follow.



Salisbury Experiment Station, 1922.





Sudan grass aftermath, 24th May, 1922, after three cuttings for hay
had been taken Salisbury Experiment Station



Maize on right after Niger oil. Maize on left after linseed.
Salisbury Experiment Station, 1922.

Maize and Sunflower Rotation.—This experiment, which is carried out on quarter-acre plots, was laid down to ascertain to what extent sunflower can be regarded—as it often is by Rhodesian farmers—as a useful change crop. One plot grows maize every year, and on the other two plots maize and sunflower are alternated each season. The results to date indicate that in Rhodesia sunflower is not an exhausting crop and may beneficially be grown in rotation with maize. The probable explanation of this is that our soils are usually well supplied with potash, on which plant food the sunflower makes its chief demand. The land used here has been under crop since 1910, has constantly been rotated with legumes and for three years was under dhal, but has never received manure.

	1921-22.	1920-21.
Maize after maize	8.75 bags.	23.00 bags.
Maize alternating with sunflower ...	10.75 bags.	22.25 bags.
Maize after dhal for two years ...	10.5 bags.	—

Maize Following Various Other Crops.—These experiments were initiated with a view to ascertaining the effect of sundry “previous” crops on a following maize crop and so acquiring a knowledge of the probable result of substituting one crop in a rotation for another crop. Preliminary trials were commenced in 1919, but the full series did not begin until a year later. This season’s results are as follows:—

	1921-22. bags.
Yield of maize per acre after Sunn hemp, reaped	10.25
“ “ “ Sunn hemp, burnt on land	11.25
“ “ “ Sunn hemp, ploughed under	12.5
“ “ “ velvet beans, reaped	9.4
“ “ “ velvet beans, ploughed under	10.75
“ “ “ ground nuts, reaped	9.00
“ “ “ ground nuts, ploughed in ..	9.4
“ “ “ Niger oil, reaped	8.5
“ “ “ Niger oil, ploughed under ...	10.5
“ “ “ hibiscus, reaped	7.5
“ “ “ hibiscus, burnt on land ...	9.5
“ “ “ oats, reaped	8.75
“ “ “ linseed, reaped	8.25
“ “ “ cotton, reaped	8.5

The series must naturally be continued for several years before any definite conclusions can be drawn, but the points of interest which emerge this season are:—

- The increased yield, viz., an *average* of 10.3 bags per acre following legumes as compared with an *average* of 8.7 bags following non-legumes.
- The heavier yields due to ploughing under a legume or Niger oil as compared with ploughing under only the stubble of the same crop.

- (c) The improvement in yield when hibiscus was burnt on the land and the ash spread, compared with when the whole crop except roots was removed from the land.
- (d) The low yield following cotton, which, owing to its deep-rooted system, has often been claimed to have a beneficial effect on the land.

Average yield of all plots in above series ... 9.5 bags per acre.
 Average yield after all legumes reaped ... 9.45 bags per acre.
 Average yield after all legumes ploughed under 10.9 bags per acre.
 Yield after Sunn hemp (legume) burnt ... 11.25 bags per acre.
 Yield after hibiscus (non-legume) burnt ... 9.5 bags per acre.
 Yield after Niger oil (non-legume) ploughed under 10.4 bags per acre.

It should be explained that *hibiscus burnt* is included in this series, since on many fallowed lands it becomes a troublesome weed, and if allowed to mature is difficult to plough under. If it can be ploughed under while young, this would probably be the best course, but where this is not possible, cutting and burning on the land would seem beneficial.

Green Manuring v. Ploughing in of Stubble only.—The preparatory crops were planted in 1919-20 and were followed by maize in 1920-21. In order to ascertain whether the benefits of green manuring would be more apparent in the *second year after treatment*, maize was again planted on these plots last season.

Yield in bags per acre.

System of cropping.	1921-22.	1920-21.	Average for two years.
Maize after Niger oil, stubble ploughed in ...	10.5	25.25	17.87
Maize after Niger oil, stubble ploughed in ...	7.75	16.6	12.17
Maize after Niger oil, whole crop ploughed in ...	10.0	23.75	16.87
Maize after Niger oil, whole crop ploughed in ...	7.0	16.75	11.87
Maize after velvet bean, stubble ploughed in ...	11.75	26.75	19.25
Maize after velvet bean, whole crop ploughed in ...	10.0	26.5	18.25
Maize after Sunn hemp, stubble ploughed in ...	8.75	23.0	...
Maize after Sunn hemp, whole crop ploughed in ...	9.0	18.75	13.87
Maize after lupine, stubble ploughed in ...	8.3	...	...
Maize after lupine, dry stalks and fallen leaves ploughed in ...	9.0	...	...

It will be noticed that in this experiment, after making due allowances for differences of season, the yields this year support those of the previous season and show no clear indication of an advantage in turning under the entire crop except in the case of lupines. This is contrary to what might be expected and may be due to as yet undetected differences in soil fertility. A decision as to the relative methods of each treatment can only be arrived at when the trials have been continued for several years longer.

Percentage of Maize Plants in a Stand.—This experiment aims at demonstrating the great importance of a full stand of plants to every acre planted. It is usually estimated that the average stand of maize throughout the maize belt does not exceed 60 per cent. of plants, and very many fields fall much below this. The average distance of planting in Rhodesia and the one usually found to give the best yield is somewhere about 36 x 18 ins. At this spacing an acre under full stand will carry 9,680 plants, and if each plant produced half a pound of grain, the yield would be twenty-four bags per acre. It is at once obvious how great a reduction in yield there will be if the acre only carries 60 per cent. of plants, even though with the thinner stand individual plants may bear more heavily. Herein normally lies a great leakage in yield, and one which can largely be obviated by (a) greater attention to the preparation of the seed bed; (b) care that the planter is in proper working order, and (c) use of uniform-sized seed of strong vitality.

The exceptionally dry season has reversed the usual results. Last year the removal of 10 per cent. of plants reduced the yield by 2 bags an acre, and 25 per cent. of plants by 7 bags an acre. This season the highest yield of 13.5 bags per acre has been given by the 90 per cent. stands, while the perfect stands and the 75 per cent. stands have both yielded approximately the same, viz., 12 and 12.5 bags per acre. Thin planting is frequently advocated in countries of light rainfall, as the fewer the plants per acre within reason, the more moisture available for each. It is thus not surprising to find that the full stand, which with a normal rainfall of about 30 ins. gives the heaviest yield, is this year, with a precipitation of only 16½ ins., placed at a disadvantage.

Date of Planting Trials.—The question of time of planting in order to get the best yield depends principally upon weather conditions and on the state and condition of the land. Experiments were conducted on the same lines as in past years and confirm previous results, the heaviest yields being obtained from the earliest plantings which the season permits. There remains no doubt that on the high veld the months of December and January are those in which maize makes its best growth. If good stalk and leaf development can be obtained by the end of December, and provided steps have been taken to check stalk borer, fair to good yields may then be relied upon. Under such conditions, and assuming the land has been properly prepared, plantings from the middle of November to mid-December will give the best yields.

Distance Planting Trials for Grain and Silage.—Maize may be planted too closely or too thinly for its most economical development. The effect of close planting on the Salisbury Experiment Station was very noticeable during the past dry season, and on plots planted 2 ft. by 15 ins. and 2 ft. by 18 ins. the plants failed to produce any yield of grain worth recording.

In previous distance of planting trials the best yields of grain have resulted from the generally accepted spacing of 40 ins. between the rows and 15 ins. between plants in the row. Not only has the total yield of grain been greatest from plots thus planted, but the grain has been of better quality than when planted more closely. If, on the other hand, the crop is required for green or dry fodder, the smaller ears, finer stems and greater abundance of foliage produced by thicker rates of planting are desirable.

Distance of rows apart.	Distance of plants apart in row.	Yield of grain per acre.
24 inches	15 inches	Failed to produce grain. Cut for silage.
30 inches	15 inches	3.5 bags.
36 inches	15 inches	4.2 bags.
40 inches	15 inches	6.35 bags.
24 inches	18 inches	Failed to produce grain. Cut for silage.
30 inches	18 inches	2.2 bags.
36 inches	18 inches	3.85 bags.
40 inches*	18 inches	2.8 bags.
Distance of rows apart.	Distance of plants apart in row.	Yield of green fodder per acre.
24 inches	15 inches	13,272 lbs.
30 inches	15 inches	12,992 lbs.
36 inches	15 inches	13,776 lbs.
40 inches	15 inches	14,392 lbs.
24 inches	18 inches	16,800 lbs.
30 inches	18 inches	13,720 lbs.
36 inches	18 inches	12,622 lbs.
40 inches*	18 inches	9,772 lbs.

* In the course of the experiment it became evident that the soil of the plots on which the 40 x 18 ins. plantings were situated was not as fertile as that of the remaining plots. The yields of these are, therefore, probably lower than they should be. Last year the 40 x 18 ins. planting gave the second heaviest yield of grain and was equal with the 40 x 15 ins. in yield of fodder. The stems, however, were unduly coarse either for hay or silage.

Variety Trials.—These were conducted with the following varieties, and the yields, in bags per acre, were as shown below. All plots were sown 24th November.

	1922.	1921.	1920.	Average.
Salisbury White	7.1	17.5	14	12.86
Potchefstroom Pearl	8.3	17.1	12.8	12.7
Hickory King	6.65	14.9	10.3	10.61
Louisiana Hickory	9.1	—	—	—
Mennie (hybrid)	8.2	—	—	—

Growers' Trials.—(Salisbury White).—This is a continuation of tests commenced in 1919-20, the object being to ascertain to what extent some of the principal growers of this variety have succeeded in fixing the breed to a definite 12-row type. Unfortunately in 1920-21 this aspect of the test was overlooked and only the relative yields were recorded. The following, however, were the results obtained this year.—

TABLE OF RESULTS—GROWERS' TRIALS.

Source of seed.	8 row.	10 row.	12 row.	14 row.	16 and 18 row.
Station grown	2 per cent.	26 per cent.	48 per cent.	18 per cent.	6 per cent.
Pek ...	4 ..	23 ..	45 ..	25 ..	3 ..
Black ...	3 ..	31 ..	43 ..	19 ..	4 ..
Townsend	12 ..	35 ..	40 ..	10 ..	3 ..
Smith ...	14 ..	39 ..	35 ..	10 ..	2 ..

The seed with which these trials were conducted has now been grown on the Experiment Station for three seasons, and each year, in order to keep the strains pure, has been artificially pollinated. This has apparently had an injurious effect, as the percentage of plants now producing 12-row ears is very considerably less than in the first year of the experiments, when 65 per cent. was the average number of 12-row ears from seed from all sources. In future it is proposed to obtain fresh seed from the grower each season.

The yields, by weight, in bags per acre have been as under:—

	1922.	1921.	1920.	Average.
Station grown	11.5	22.1	12.4	15.3
Townsend	11.2	19.4	12.8	14.4
Black	10.5	22.6	11.1	14.7
Smith	10.2	17.2	13.3	13.6
Pek	10.0	20.3	11.0	13.8

A somewhat similar test was carried out to ascertain the degree to which selected ears from a Salisbury White strain would breed true to the number of rows in the parent ear. The results, which are comparable with those reported on in the annual report for 1919-20, were as follows:—

Source of seed.	Rows in parent ear.	Produced 8 row ears.	Produced 10 row ears.	Produced 12 row ears.	Produced 14 row ears.	Produced 16 row ears. 18 row ears.	
Station	16	... = 0 per cent.	69 19 per cent.	144 40 per cent.	112 31 per cent.	28 10 per cent.	5
Station	14	7 = 2½ per cent.	70 22½ per cent.	138 44½ per cent.	88 28 per cent.	6 2½ per cent.	1
Station	12	6 = 2½ per cent.	86 36 per cent.	99 42 per cent.	38 16 per cent.	9 3½ per cent.	...
Station	10	17 = 10 per cent.	74 44 per cent.	64 37 per cent.	14 9 per cent.	... 0 per cent.	...
Smith	14	8 = 2½ per cent.	80 24 per cent.	158 48 per cent.	74 22½ per cent.	10 3 per cent.	1
Smith	12	16 = 5 per cent.	104 31 per cent.	177 53 per cent.	35 10 per cent.	1 ½ per cent.	...
Smith	10	60 = 21 per cent.	177 62 per cent.	46 16 per cent.	2 1 per cent.	... 0 per cent.	...

In these experiments also the results have now largely been vitiated by artificial pollination of the seed ears used each season. The tests, however, do afford some indication of the extent to which the progeny of an ear with any given number of rows will breed true to that number and also of the limits between which it is likely to fluctuate seriously.

Seed from Smooth and Rough Ears.—The object of this trial is to ascertain the extent to which plants raised from ears possessing the character of roughness or chaffiness and those also possessing the character of smoothness will breed true to this character. The point is of great importance when it is desired to breed seed maize to any special degree of smoothness or roughness. The trial must be continued before final conclusions can be drawn.

Smooth Ears.

Rough Ears.

735 plants raised from seed from smooth ears produced 727 = 99 per cent. 8 = 1 per cent.
770 plants raised from seed from rough ears produced 686 = 89 per cent. 84 = 11 per cent.

Seed from Long Ears and Short Ears.—To ascertain to what extent length in the ear is a hereditary character.

	Ears over 8 ins. in length.	Ears under 8 ins. in length.
368 plants raised from seed from short ears produced	25 = 7 per cent.	343 = 93 per cent.
364 plants raised from seed from long ears produced	92 = 25 per cent.	272 = 75 per cent.

Length of ear is naturally to some extent governed by season and soil, and the great number of short ears in the above results is probably in part due to the drought.

Seed from Ears with Short Sheaths (i.e., Tips of Ears Exposed) v. Long Sheaths.—To ascertain the extent to which exposed tips can be overcome by selection of seed ears with well developed sheaths, entirely covering the tip of the ear.

	Exposed Tips.	Well Covered Tips.
400 plants raised from ears with exposed tips produced	319 = 78 per cent.	91 = 22 per cent.
410 plants raised from ears with tips well covered produced	83 = 20 per cent.	327 = 80 per cent.

These results, if compared with those of last year, indicate that while an exposed tip may in part be due to weather conditions, yet ears with long sheaths will continue to produce well covered tips even in a dry season. On the other hand, seed taken from ears with exposed tips may not show this fault seriously in a favourable season, but in a year of drought the defect will be reproduced in a high percentage of the progeny.

Brown Spot on Kernel.—All maize growers are aware that with increasing depth of kernel a tendency has lately arisen, especially in wet seasons, for the base of the grain where it is attached to the core to be discoloured with a brown tint. This defect is commonly known as Brown Spot, and it has not yet been shown whether it is a serious fungoid or bacterial disease or is merely due to a seasonal effect on well-packed deep-grained ears. The trouble must not be confused with *Diplodia*, although it is possible that under favourable conditions Brown Spot may develop into *Diplodia*. A trial was commenced last season to test the effect on the resulting crop of planting seed suffering from Brown Spot. Three hundred and eleven fertile plants were raised from such seed, and these produced—

Ears with grain showing discoloration	36 = 11 per cent.
Ears with grain showing no discoloration	295 = 89 per cent.

The dry season was probably unfavourable to the appearance of the defect and the tests will be continued.

(To be continued.)

Seed Supply in Rhodesia.

By C. MAINWARING, Agriculturist.

The present sources of our seed supply (with the exception of maize, which is produced in the country) is such as to cause grave apprehension. More than ten thousand acres of land are annually sown to wheat, oats, barley, rye, teff and manna. The acreage is rapidly extending, and clean virgin veld is constantly being brought under cultivation with these crops. Seed is obtained from two sources: either it is grown in Rhodesia or it is obtained from outside. Mostly the latter plan is adopted, especially in the case of winter cereals. For the purpose of obtaining some definite information regarding the quality of the agricultural seeds offered for sale by seed merchants outside Rhodesia, twenty-seven samples of oats, described as seed in the advertisement columns of a farmers' paper, were obtained by this Department. Information was given with most of the samples, stating the name of the variety, the name and address of the seller and the price per bag. The following table, which speaks for itself, gives a summary of the results of the analysis of the twenty-seven samples:—

RESULTS OF SEED INVESTIGATION.—OAT SEED SAMPLES (PERCENTAGE BY COUNT).

Sample No.	Name of variety.	Quality of grain.	Foreign matter.	Noxious weeds.
1	Garton Oat	Light, immature	Contained dirt and chaff	Free.
2	Algerian Oat	Sound, plump and large	Badly cleaned	10 per cent. drabok (darnel).
3	Algerian Oat	Light, immature sample	Contained wheat and barley	3 per cent. drabok (darnel).
4	White Egyptian Oat	An excellent sample	Chaff and dirty	Free.
5	Winter Dun Oat	Grains uneven	Chaff, stalks and dirt	3 per cent. polygonum (wild buck wheat).
6	Winter Dun Oat	A fair even sample	Clean	Free.
7	Cape Algerian Oat	Dull colour, grain plump	Fairly free from dirt	13 per cent. drabok and wild oats.
8	Algerian Oat	Sample good	Clean	3 per cent. drabok (darnel).
9	Algerian Oat	A nice sample	Clean	Free.
10	Algerian Oat	Lacks brightness, even grain	Clean	Free.
11	Algerian Oat	Excellent sample	Clean	Free.
12	Winter Dun Oat	Very poor, musty	25 per cent. dirt and chaff	4 per cent. wild oats.
13	Algerian Oat	Mixed	Free	Free.
14	Boer Oat	Light and immature	Fairly clean	2 per cent. erigeron sp.
15	Winter Dun Oat	Heavy plump grain	Very dirty, chaff and stalks	Free.
16	Sidonian Oat	Well grown	Clean	Free.
17	Winter Dun Oat	Very good	Clean	Free.
18	Algerian Oat	Fair, uneven	Dirty, grit and chaff	7 per cent. polygonum sp.
19	Algerian Oat	Light and immature	Clean	Free.
20	Algerian Oat	Mixed sample	Clean	Free.
21	Algerian Oat	Light	Clean	4 per cent. setaria sp.
22	Algerian Oat	A well-grown sample	Very dirty, stalks and chaff	15 per cent. drabok and wild oats.
23	Winter Dun Oat	A good sample of grain	Very dirty, not winnowed	3 per cent. wild oats.
24	Algerian Oat	Very uneven	Fair	4 per cent. amaranthus and hibiscus sp.
25	White Oat	A mixed sample	Not winnowed	Free.
26	Boer Oat	Very uneven, true to type	Not winnowed	Free.
27	Algerian Oat	Wrongly named	Clean	Free.

From the same source.

From the above table it will be observed that out of the twenty-seven samples only six of them can be classed as seed and suitable for sowing with the prospects of reaping a satisfactory and clean crop. The loss to the farmer buying and sowing such inferior grain, and containing such impurities as dirt, chaff, stalks and dead seed, is great, but the most serious and far-reaching loss is the sowing on clean virgin land of seeds containing large numbers of noxious weed seeds. With very few exceptions, the worst weeds in Rhodesia are not native; they have and are being introduced from other countries—largely through imported seeds. With our yearly increasing acreage of land planted to cereals, the necessity of preventing as far as possible the introduction and spread of weed seeds is apparent. For farmers to sow grain containing noxious weed seeds is most unwise, but it is being done each season. As soon as the farmer will take as keen an interest in the seed he plants as he does in the cattle he breeds we shall have made the right impression. To maintain a sharp look-out for troublesome weed seeds pays, because weeds are much more easily kept out than eradicated. Unfortunately in Rhodesia we can grow fairly good crops from indifferent seed. Our virgin lands, the tropical rains and our bright sunshine all help to this end. This is a misfortune, but if we can grow good crops with indifferent seed, we can grow better crops with better seed. The farmer to protect himself should always insist on seeing a sample of the seed before he makes his purchase. There is no excuse for buying and sowing bad seed, for it is always open to the farmer to submit such samples to the Department of Agriculture for examination and report.

The Cattle Industry.

By ERIC A. NOBBS, Ph.D., B.Sc., F.H.A.S.

The Government of Southern Rhodesia, in response to representations arising out of a meeting of breeders of cattle held in Salisbury and subsequently supported by the Cattle Owners' Association and the Rhodesia Agricultural Union, have appointed a Committee of Enquiry for the purpose of ascertaining—

- (a) the quantity and quality of cattle available for export now and in the future;
- (b) the markets to which the industry may look for the disposal of such surplus;
- (c) the best means of encouraging and developing export to such markets; and
- (d) generally as to the prospects of the industry, and the possibilities of improving the position in regard thereto.

The purpose of the Committee is primarily to consider and discuss problems to this end, making enquiries as may be deemed necessary and to furnish its studied conclusions and advice to the Government.

The personnel of the Committee is as follows:—Messrs. M. E. Cleveland, C. S. Jobling (President of the Rhodesia Agricultural Union), H. U. Moffat and O. Rawson (Chairman of the Cattle Owners' Association), with the Director of Agriculture as Chairman. The Committee will hold its first meeting early in October.

Whilst the position of the cattle industry is well enough known and understood by cattle men in Rhodesia, it is hoped that this Committee will serve a good purpose in eliciting opinions and suggestions from those interested and thus bring to a focus the views of all interested. It may be instrumental in calling the attention of those concerned in the meat trade in other parts of the world to the special attractions in this respect which Rhodesia has to offer.

The times, especially to men concerned in our cattle raising industry, are very trying. Added to the accumulation that is going on of full grown stock, we are now feeling the effects of the drought that has been with us since the beginning of the year. Though not as serious as anticipated by those who were unfamiliar with conditions throughout the country, the drought has undoubtedly caused much loss in condition, as well as some mortality from poverty, which may be heavier unless early rains relieve the situation, and it must unfavourably affect the calving season. Several instances of serious

losses are attributable to neglect to take the precautions which long warning should have rendered easy and obvious. In districts where quarantine restrictions are in force the difficulties are greater, and in some cases insuperable. Elsewhere veld fires have destroyed what grazing there was, but on the whole the cattle of the country have not suffered so much as might have been expected and as has occurred in other years. Apparently the grass, though scarce, has on account of the drought "cured on the stalk," and retained its nutrient properties and its palatability more than in normal seasons, whilst the water supplies have held out in a remarkable manner. Trekking has by no means been general, and a tour of the country literally from one end to the other during the past couple of months has brought out the fact that it is the exception for stock to be in dangerously low condition. They are now, however, rapidly falling off, and much depends on the date and nature of our first rains.

Besides the drought, the continued lack of markets gives rise to grave anxiety, and is constantly becoming more and more evident and pressing.

In spite of these facts—and it is a striking proof of confidence in the country—a keen demand for bulls was manifested at both sales in the show grounds at Bulawayo and Salisbury. Certainly prices were lower than in past years, but that is in accord with the general fall in values; the number of buyers was, however, greater than ever, while bidding was spirited, and the figures paid really quite remunerative. Breeders in the south who sent up stock for sale, such as Sir Abe Bailey, the Friesland Breeders' Association, the Devon breeders and others, have expressed satisfaction at the prices, and even more at the prospects for future business on an ever increasing scale. An increasing discrimination amongst breeders is noticeable, and pedigree and foreign origin alone will not do; prices fall at once where the quality does not come up to standard. Everywhere the cry is for bulls and better bulls, and given good seasons and markets for the progeny, Rhodesia may be regarded as a permanent buyer of bulls and breeding stock far beyond anything reached so far.

Some months ago we had a visit from an American gentleman, a very large rancher in the United States, whose entire life has been spent in this line, and who knows the subject alike from the point of view of the cow puncher and meat packer. To this experience he has now added the knowledge gained by a personal visit to all the more important cattle countries of the world, including Australia, India, South America and Europe, and every State of his own country. The outcome of his observations on this trip, which was taken not for pleasure but for business, is contained in an interesting letter recently received, from which we take the liberty of quoting the following passage:—

"We reached home on 28th May after spending three years and one month on our trip round the world. It is my opinion that a large investment in Rhodesian land and cattle offers for the future greater inducements than anything I have seen in the whole trip. Of course, to make this a success a man must be a cattle man and

willing to live with it. Business by proxy does not often succeed; and the profit is away off in the future. It requires a good deal of nerve to make an investment of that kind under present world conditions, but if I had the money and were thirty years younger I certainly would come back to Rhodesia and ask your assistance to find me a suitable location at the value of land to-day. This depression cannot last always. The man who buys his land and cattle to-day, when everyone wishes to sell and no one wishes to buy, is the man who will reap the greatest profit."

This unsolicited testimonial in regard to the position and prospects of Southern Rhodesia as a cattle country from an unbiased and highly informed authority will be read with pleasure by those who are already ranching in Rhodesia, and deserves the careful consideration of those meditating such a course.

A statement of the utmost importance to the cattle industry of Southern Rhodesia is reported in the daily Press as having been made by Mr. C. E. Gunther, Chairman of Liebig's Extract of Meat Co., Ltd., who with Mr. F. Holt, also a director of that company, has, after an interval of ten years, been visiting the Mazunga Estate. In the course of conversation Mr. Gunther is reported to have said that "Liebig's are prepared and most anxious to put up big works at Mazunga to deal with the present Rhodesian cattle, but we must see the railway first."

This view was further elaborated, and it appears that any such meat works would draw supplies not from Mazunga only, but from all over Rhodesia, an intention stated to the writer by Mr. Gunther on the occasion of his previous visit. Mr. Gunther, as reported, referred only to canning and extract, and is quoted as saying, "In London to-day there is a market only for the very best chilled beef." In Rhodesia we would be well satisfied for some years to come to cater for other markets than London, which is notorious as the most exacting, and there are good grounds for thinking that this country can provide freezers of a quality quite suitable for continental markets when once international trade conditions make it possible for Europe to import meat.

This announcement by Mr. Gunther synchronises unfortunately with the cessation of operations for the second time of the Odzi Canning Factory, a great disappointment to its supporters, as it was hoped that it would achieve the very purpose contemplated in the Mazunga proposal, possessing as it does the advantage of a railway at its doors. It is hardly credible that, with the country congested as it is with unsaleable cattle, a factory equipped and demonstrated to be capable of producing the goods should be permanently closed and abandoned.

Simultaneously with these events there is news of a project for the establishment of a meat canning factory at Durban, where already there are several meat freezing works in existence. Any step intended to turn to account the growing surplus of cattle at any point in the sub-continent is to be welcomed.

The History, Control and Treatment of Infectious Abortion of Cattle

IN SOUTHERN RHODESIA.

By, LL. E. W. BEVAN, M.R.C.V.S., Director of Veterinary Research,
Southern Rhodesia.

Infectious bovine abortion is at the present time the most serious menace of the cattle industry in most parts of the world. The direct and indirect losses due to this disease are inestimable; its insidious nature and the difficulty of detecting it until a depleted calf crop indicates its presence, the associated losses in dairy products and the general interference with business render it the most costly of bovine diseases.

Infectious abortion is said by some to have existed from time immemorable in Southern Rhodesia, but the evidence advanced by those that hold this view is somewhat unreliable, it being based upon the statements of natives whose diagnosis must always be accepted with some reservation. No doubt abortions have frequently occurred in the past among native stock, and, in view of the method of breeding and management of such cattle, this is not surprising; but whether these have been due to the *B. abortus* of Bang or other causes it is impossible to say. Had abortion disease existed as an epizootic it is doubtful whether the rapid recuperation of the cattle industry in so short a time after the ravages of rinderpest, pleuro-pneumonia and East Coast Fever would have been possible.

Certain it is, however, that in 1906 an outbreak of abortion occurred in a herd of dairy cattle on the Salisbury Commonage which was promptly dealt with and, it was hoped, suppressed. "Enzootic abortion" was then placed in the list of diseases to which the provisions of Part I. of the Ordinance No. 9 of 1904 applied. The circumstances associated with this outbreak suggested specific infectious abortion, but the agglutination test was not then applied. In 1913, however, by means of this test Bevan proved the presence of infectious abortion in two herds, the one recently imported from Northern Rhodesia and the other in the Marandellas district. The following particulars are taken from the annual report of the Government Veterinary Bacteriologist for the year 1914:—

"In November, 1913, information was given that a herd of cattle, at that time in quarantine on the Zambesi, were suffering from contagious abortion, and, on the arrival of these animals at Sipolilo, blood was taken from certain suspicious cases and was tested at the laboratory, with the result that it was found that four animals gave a marked positive re-action to the agglutination test. The matter being of such importance, the greatest care was taken in the performance of the test, for which three distinct strains of contagious abortion cultures were used, namely:—

- (1) strain from the Pathological Laboratory of the Royal Veterinary College, London;
- (2) strain from the Nairobi Laboratory, British East Africa;
- (3) strain from the Onderstepoorte Laboratory (South African strain).

"It is of interest to note that the re-actions with each strain closely corresponded, indicating that the specific contagious abortion of those countries, namely, Great Britain, British East Africa, Union of South Africa and Rhodesia, are identical. Samples of the same blood were sent to Sir John McFadyean, of the Royal Veterinary College, London, who was able to confirm the diagnosis.

"About the same time cases of abortion occurred on the farm Gatsi, Marandellas, and on the application of the test these were found to be due to the *B. abortus*. Recent investigation into this outbreak suggests that the disease originated some five years ago from an imported Devon bull, which was sold to a farmer in the Marandellas district, with the result that the disease became so prevalent in his herd that he was eventually compelled to sell his stock and farm. The dispersal of infected animals has led to the dissemination of the disease throughout the district, and at the present time the outbreaks are apparently of a less serious character than hitherto."

This report was strongly resented by the members of the Marandellas Farmers' Association and the Mangwendi Farmers' Association, who, at a meeting held on 7th July, 1914, passed a vote of censure upon the writer on the grounds that "if such a statement was allowed to pass unchallenged, it would at once close the district for export of cattle to any other district. No one in the district knew of a proved case of contagious abortion, and no serious cases of even ordinary abortion had occurred." (*The Farmers' Weekly*, 28th July, 1915). Subsequent events, however, proved in a most unfortunate manner the accuracy of the diagnosis and justified his timely warning.

In the *Rhodesia Agricultural Journal*, October, 1915, the Chief Veterinary Surgeon offered the following opinion:—

"Contagious abortion is not a recent introduction into Rhodesia; it has existed for many years, but in such a mild form that it has escaped detection. If such is the case, it is scarcely possible for it to assume the economic importance which it holds in other countries."

This optimistic forecast has unfortunately not been fulfilled, since at the present time the disease exists from one end of the country to the other, sometimes in a mild form, characterised by a shortage of calves and an increasing number of barren or sterile cows, at other times in such an acute form that the birth of a healthy, fully-developed calf is an exceptional occurrence. Not only does it affect dairy and better bred stock, but also indigenous and range cattle belonging to Europeans and natives alike. Within recent times, also, human beings have become infected with some mysterious malady manifested by symptoms resembling undulant fever and producing in the blood elements causing a specific re-action with the *B. abortus* of Bang when submitted to the agglutination test. This fact is all the more serious in the light of recent observations made in this and other laboratories in many parts of the world, showing a close similarity between the *B. abortus* of Bang and the *Micrococcus melitensis*, the causal organism of undulant or Malta fever, and it would almost appear that the two organisms may be merely derivatives from a common source.

The rapid dissemination and widespread distribution of infectious abortion in Southern Rhodesia is not so much a matter for surprise when it is remembered that in no part of the world have administrative measures proved availing to avert the spread of infection. Indeed, in some countries they have been imposed only to be withdrawn, their futility becoming obvious as soon as attempts have been made to apply them in practice. On the other hand, in Rhodesia recent efforts to cope with the disease have been attended with most satisfactory results, and it is the object of the present article to draw attention to the methods employed, in the hope that they may be adopted and improved upon in other parts of the world and so contribute to the final victory of the veterinary profession over this insidious malady.

In December, 1915, Bevan contributed to the *Rhodesia Agricultural Journal* "A Note on Contagious Abortion," in which, after again emphasising the danger of the disease, he introduced certain new methods of coping with it. He wrote:—

"Commencing with a few isolated cases, the infection may become established in a herd, causing a very serious loss in calves for several years; it is, therefore, desirable to detect the first cases in order that measures may be adopted to limit the infection. At one time, owing to the absence of any very remarkable features to distinguish the specific disease from accidental cases of abortion, this was a matter of considerable difficulty, but recently a very reliable laboratory test has been discovered whereby the presence of the disease can be detected by certain properties in the blood-serum of the infected animal.

"As the result of experiments in the Veterinary Laboratory the technique of this test has been so simplified that any stock owner can himself obtain the blood from a suspected animal and forward it to the laboratory in a suitable condition for the test. A stock of the materials necessary, and full particulars as to the process, can be obtained from the nearest office of the Veterinary

Department, or direct from the Veterinary Bacteriologist, Salisbury.

"The detection of this disease greatly depends upon the good faith of the stock owner himself in reporting cases coming to his notice, as the only way in which its presence can become known to the inspector of cattle is by the remarkable shortage of calves in a herd where it has become firmly established. It is to the interest of the stock owner himself to avoid such a state of affairs, and this he can easily do by having his suspected animals tested.

"It is true that infected farms are placed in quarantine, but now that the disease can be controlled by preventive measures, and can be successfully combated by a process of vaccination, the quarantine need not last longer than a few months if the matter is promptly dealt with. This temporary inconvenience is little as compared with the losses which may accrue if the disease is allowed to run its course unchecked."

The testing apparatus referred to was first described in the *Journal of Comparative Pathology and Therapeutics*, December, 1915, and in the *Rhodesia Agricultural Journal*, and consisted of a modification of the Wright capsule, together with a special solution which preserved the blood until the agglutination test could be applied. The method was so simple that veterinary officers, inspectors and laymen became proficient in its use, and whereas before its application it was rare to receive a specimen of blood at the laboratory which had not undergone hæmolysis, putrefaction or other change rendering it unsuitable for the test, since its use fully ninety-five per cent. have arrived in a satisfactory condition. On the basis that "prevention is better than cure," this simple contrivance has proved of the greatest assistance to the administrative side of the Veterinary Department, enabling it accurately to diagnose the existence of the disease, and by early detection to take steps to deal with an outbreak. It may confidently be recommended for use in other countries where the disease exists.

Thus as early as 1915 considerable progress had been made in dealing with this disease as far as laboratory methods were concerned. The detection of the disease had been placed upon a simple and scientific basis, and already vaccine therapy had been introduced. Experiments were conducted having a bearing upon the best means of dealing with the disease under the peculiar local conditions. The principle of systematic dipping having been widely adopted in connection with other diseases, it was desired to ascertain whether the constituents of the five-day dip exerted any harmful effect upon the *B. abortus*, for if so the dipping of stock would tend to eliminate the disease by disinfecting the contaminated animals, but if not the passage of such animals through the common dip would lead to the pollution of the dipping fluid and the possible infection of all susceptible animals passing through it. The laboratory tests indicated that Cooper's Improved Dip, and other arsenic-containing solutions in strengths suitable for five-day dipping, were rapidly harmful to the abortion organism.

At a meeting of the professional officers of the Veterinary Department, held in the Veterinary Laboratory, Salisbury, in August, 1920, to discuss the disease, it was decided that:—

“Official quarantine of infected farms and herds was impracticable and tended to defeat its own ends by leading to the suppression of information as to the existence of the disease. Similarly the publication of notices on the doors of Magistrates’ Courts and in the *Government Gazette* was not desirable. It was admitted that the only method at present available to the Veterinary Department of limiting the distribution and dissemination of the disease was in the power of veterinary officers to refuse permits for the removal of infected or suspected cattle.

“It was decided that the best method of controlling the disease from the point of view of veterinary administration was to educate and assist the public, and it was suggested that veterinary officers should, when possible, deliver lectures on the subject in their respective districts.

“It was agreed that the best method of detecting or determining the specific nature of an outbreak of abortion was by Bevan’s modification of the pipette method of collecting blood for the agglutination test.

“It was agreed that the reports received from veterinary officers and stock owners as to the efficacy of the vaccine as prepared at the Veterinary Laboratory by the Bacteriologist were most satisfactory, and it was decided that the method should be recommended and applied when possible—that is, when supplies were available.

“It was decided that all female stock in an infected herd should be vaccinated with devitalised vaccine, including calves, and in this way an immune herd should be established. New stock should not be introduced to the herd until a normal calf crop indicated the immunity of the herd, and then only after inoculation.

“It was agreed that so-called ‘queen’ cows were a source of danger and should be tested, and, if re-acting, should be destroyed.

“It was decided that vaccine should be issued through the district veterinary surgeons in order that they might be aware of the existence of the disease in their districts, the first vaccination to be under the control of the veterinary officer in charge, but if necessary subsequent injections to be performed by the owner.

“It was thought necessary to point out to owners that the vaccination could not restore life to a dead foetus, but might hasten immunity of an animal which had aborted and prevent non-pregnant animals becoming infected.

“It was pointed out that a considerable number of barren cows failed to re-act, and that these could only be destroyed at the owner’s discretion. The cause of their condition was probably other than infection by the *B. abortus*.

"It was decided that in all outbreaks an attempt should be made to trace the source and origin of the infection. It was considered desirable to apply the test when a number of cases of retention of after-birth was reported in a herd."

Again on the 12th November, 1921, the disease was the subject of prolonged discussion by the Southern Rhodesia Veterinary Association, and the decisions arrived at formed the basis of the present methods. The following procedure was recommended to be adopted by veterinary officers in dealing with herds of cattle infected with abortion:—

1. No permit to be granted for the removal of breeding stock of any age, including bulls, until the completion of vaccination, except that animals may be permitted to travel to some convenient centre for immediate slaughter.
2. All animals which have aborted to be segregated if possible for at least six months from date of abortion.
3. Bulls to be tested to start with, and if found to re-act to the agglutination test, to be re-tested after an interval of three months. They should not be returned to the herd until showing a negative re-action to the test. The owner should be advised to castrate or destroy any bull re-acting a second time.
4. No permits to be issued at any time for the removal of bulls known to be affected except for immediate slaughter.
5. Vaccination to be carried out strictly in accordance with the instructions issued with the vaccine.
6. During the process of vaccination every effort to be made to eliminate infection by ordinary prophylactic measures, such as disinfection of females which have vaginal discharges, the destruction of discharged matter, the cleaning up of possible infected kraals, buildings, etc., and the limitation of communication between treated and possibly infected herds.
7. Veterinary officers dealing with an outbreak to endeavour to discover the source of infection, *i.e.*, infected grazing, water pools, cattle kraals, sheds, neighbourhood of dipping tanks, etc., "queens" and barren cows and "carrier" bulls.
8. Where vaccination is not carried out no permits to be issued for breeding stock of any age, including bulls, for twelve months after the discovery of the disease. At the expiration of this period the position to be reported to the Chief Veterinary Surgeon for further consideration.

Having discussed what may be called the administrative methods adopted, the therapeutic measures, especially the special system of vaccination referred to, may be more fully dealt with.

Infectious abortion has always been regarded by the writer as essentially a disease of the foetal membranes. In an article on "Immunity," contributed to the *Rhodesia Agricultural Journal* of December, 1916, he wrote:—

"... the bacillus of abortion produces its harmful effects upon the lining membranes of the womb and the envelopes of the fœtus; and although it may gain entrance into the body through the mouth and travel from the alimentary tract by way of the circulation to the uterus, it apparently does not cause any harmful effects to tissues *en route*. If there is no fœtus no harm is done; and it is known that if a cow that has aborted is kept from the bull for a period of about six months, the infection of the womb dies out."

It is therefore interesting to find this opinion expressed again as recently as February, 1922, by Schroeder in a paper presented at a meeting held at the University of Pennsylvania. This great authority states:—

"... The true habitat of the micro-organism, and the real seat of its pathogenic activity, is the fœtal envelope, and though it often enters and persists during varying periods of time in the udder, it does not seem to multiply abundantly in this organ, and has not been proved to cause disturbances. As far as we know, everything that happens to the cow and the fœtus when abortion disease occurs is consequent on the pathological changes in the fœtal envelope."

It has been generally believed that in other countries abortion tends to wear itself out. It has also been held that an animal seldom aborts at two successive pregnancies. Moreover it was found by the Departmental Committee, appointed by the Board of Agriculture & Fisheries to enquire into epizootic abortion, 1905, that "... It is highly improbable that abortion bacilli remain for a long time active in the bodies of non-pregnant animals."

From the above it would appear that in nature an immunity is set up. On this hypothesis it has been sought to create immunity by introducing into non-pregnant animals large numbers of the live abortion bacilli grown artificially, and in Great Britain and elsewhere vaccines so prepared have been used with beneficial results. But in Southern Rhodesia, where it is often difficult to determine whether a cow is pregnant or not, the introduction of living vaccine might be attended with considerable risk, for, if introduced in error into a pregnant animal, it might give rise to abortion and so set up a focus of infection. The difficulties associated with transport also render it extremely dangerous to issue a living vaccine which might become disseminated through the breaking of a bottle. Another serious danger attaching to the live vaccine is that in a limited number of cases the organism when introduced into non-pregnant animals becomes established in the udder and is carried there until such time as the animal becomes pregnant, when it makes its way to the fœtal membranes and there exerts its harmful effects and finally gives rise to abortion. Such an animal may act as a "carrier" for an indefinite period and may finally originate infection if introduced to a clean herd.

The dangers of a live or virulent vaccine have always been recognised by the writer, and until recently by the Chief Veterinary Surgeon, who in his annual report for the year 1916 wrote:—

"The recent investigations in immunisation by live cultures of the bacilli which have been carried out in England are most encouraging, but if such process is ultimately established as a satisfactory means of dealing with the disease its application in this country would be impossible except in young heifers, and even then we should require to be assured that there was no possibility of animals immunised in this way becoming disseminators of infection."

This suspicion was supported by reports which from time to time appeared in veterinary literature; thus in the *Journal of Comparative Pathology and Therapeutics* McFadyean states:—

"In 14 cows out of a total of 16 that when heifers had been inoculated subcutaneously with live bacilli in 1911, recovery at the date of the first general test in 1914 was indicated by an entirely negative result or a very low agglutination titre, but in the remaining two the agglutination indicated persisting disease."

Schroeder also, in discussing the disease at the 57th Annual Meeting of the American Veterinary Medical Association, August, 1920, in reply to a question, stated:—

"It is generally assumed that when abortion bacilli are injected subcutaneously they do not permanently infect the injected cows. When those bacilli are injected intravenously they are likely to establish themselves in the udder. I object to either method in healthy herds, because a subcutaneous injection may, at any time, unknown to the person who gives such an injection, become a partial intravenous injection."

Again Edwards, in an address read before the National Veterinary Medical Association in 1921, states:—

"At best vaccination suppresses losses due to abortion by continually keeping alive the infection."

And in reply to a question stated:—

"The only useful form of vaccination consists in inoculating animals with a live bacilli, and it (the inoculated animal) is capable of excreting those bacilli in the milk. It may be capable of excreting them with the fæces also."

At best, live vaccine could only be used in Southern Rhodesia on animals definitely known to be non-pregnant, in herds where infection already exists and by operators whose surgical technique could be thoroughly relied upon.

In the light of recent literature it is by no means certain that the live vaccine is always what it professes to be, and favourable results attributed to such vaccine must be accepted with some reservation. The term "live" vaccine is generally taken to mean one composed of living organisms possessing their natural qualities, and especially their pathogenic properties. It was therefore a matter for surprise when, at the National Veterinary Association meeting referred to, certain practitioners admitted that they had inoculated pregnant

animals with the so-called live vaccine, which to their astonishment had not produced abortion. Edwards, in explanation, stated:—

“The vaccine which was at present issued by the Ministry in England and by the Department in Ireland was undoubtedly obtained from an organism isolated many years ago, and had been kept running in laboratories for many years. Quite early in the study of the disease it had been found that the bacillus could be made to vary its virulence quite readily. Moller in America had found that with the bacilli directly isolated from the cotyledons he could produce abortion in rabbits every time, but when the organism had been cultivated on the surface of media in laboratories for a few generations, then they failed to cause abortion. So that probably the reason why one could now vaccinate pregnant animals, in direct contravention of the recommendations of the Ministry, was that the organisms which the Ministry employed for making the vaccine had become attenuated.”

It would therefore appear that this so-called live vaccine to which so many favourable results have been attributed, although perhaps alive, was not pathogenic—a distinction with a difference. It is sought to draw particular attention to this fact, inasmuch as it has an important bearing upon the principles upon which the vaccine therapy applied in this country is based.

The paper already referred to by Schroeder on “The present status of vaccination against abortion disease of cattle,” presented to the University of Pennsylvania as recently as 28th February, 1922, constitutes a somewhat formidable indictment against some of the commercial live vaccines on the market. Twenty-four of these were submitted to various tests. Fifteen only contained Bang’s abortion bacilli free from contamination. When grown on culture media, seven out of twenty-one had to be condemned as entirely or nearly dead. Some growth was obtained on twenty, but only fourteen of them yielded a growth of micro-organisms indistinguishable from Bang’s abortion bacilli. Tested against positive specific serum, seven out of twenty-four were perfectly agglutinated, three agglutinated poorly, and eight, while agglutinating slightly to positive serum, re-acted also to negative serum; the remaining six were unsuitable for the test. Schroeder sums up his conclusions as follows:—

“The real fact of the matter is that only five of the suspensions were found to be perfect with all four tests, and that means that nineteen, or 79.18 per cent. of the twenty-four, ranged in value from doubtful to positively worse than worthless.”

It would appear, therefore, that if the good results which have been claimed for the live vaccine have been obtained, it was not due to the fact that the organism was alive in the sense that it was virulent, but it is more probable that the favourable results were due to the fact that the organism used, while perhaps alive—inasmuch as it could be cultivated—had been attenuated or rendered non-pathogenic by sub-cultivation or other means. Edwards has told us how the organism may be attenuated by sub-cultivation, and Schroeder in the paper referred to states that:—

"Suspensions of abortion bacilli in normal salt solution, kept at room temperature, occasionally show a greatly reduced virulence for guinea-pigs in 24 hours, and failed to cause lesions after 48, 72 and 144 hours."

Also he says that from experiments:—

"It seems that abortion bacilli grown in receptacles in which the air is rich in carbonic gas are not as readily or perfectly agglutinated by positive abortion sera as those grown in ordinary atmospheric air."

Bevan also has found that after repeated sub-cultivations by washing off the surface growths with sterile distilled water the agglutinating power of the organism was lost. Although the pathogenicity of an organism is not identical with its agglutinating properties, there seems reason to believe that the two are in some way associated. It is perhaps fortunate for the advocates of the live vaccine that the bacillus of abortion is so susceptible to attenuation, for had it not been so the results might have been positively disastrous.

On the other hand the so-called "dead" vaccine has been generally condemned; nor is this surprising if by this term is indicated a vaccine composed of organisms and their toxins destroyed by excessive heat. The present day conception of immunity has been described as "a necessary re-action of the whole organism against each and every substance which is not a part of the organism when introduced into its interior in any manner." But if such substances are destroyed by heat, no appreciable or specific re-action can be expected. Indeed it is often a matter for surprise that in human medicine vaccines prepared in such a manner should have proved so successful. It will be found, however, that in their preparation improved results have generally followed those methods which sought to de-vitalise the organism without materially altering its constituent elements or destroying its toxins.

Notwithstanding the crude manner in which some of the "dead" abortion vaccines have been prepared and their general condemnation, some reports indicate that they are not entirely useless. For example, interesting figures are given by Zwick and his fellow workers as the result of trials conducted between 1911 and 1915. In all, 5,136 cattle from 123 herds were under observation, of which 3,006 served as controls. Among the latter during the period of the test abortions increased from 16.31 per cent. to 22.68 per cent., but among those inoculated by different methods abortions decreased from 21.21 per cent. to 15.15 per cent. Among those inoculated with dead cultures the abortions also decreased from 18.51 per cent. to 13.20 per cent. These figures suggest that some beneficial effect may follow inoculation with even a dead vaccine, and since the inoculation of pregnant animals with a live vaccine is impracticable, justify further consideration of an alternative method.

In 1915 Bevan, realising the urgent necessity for some means of combating the disease in Southern Rhodesia, carried out some preliminary experiments with a view to ascertaining the response in

animals inoculated with dead and live cultures respectively, as recorded in the *Journal of Comparative Pathology and Therapeutics*, June, 1915, and found that well marked agglutination re-actions could be obtained with dead bacilli, varying with the number of organisms used. In some instances a certain number of dead organisms caused as high an agglutination titre as an equal number of live organisms, but the re-action did not persist as long, from which it was obvious that vaccines composed of dead organisms would have to be applied at frequent intervals if the agglutinins were to be maintained. Although agglutinins are not identical with immunity, they are in some way associated with it and may be taken as an index of the progress of the immunity set up in the animal. These observations therefore encouraged further efforts to obtain a method of inoculating cattle against infectious abortion free from the dangers associated with the live vaccine in the conditions obtaining in this country.

As has already been pointed out, infectious abortion is a disease which in certain conditions tends to wear itself out, and in nature a cow which has aborted may eventually become immune. How then does this immunity become established? It can scarcely be due to the actual presence of the live organisms, because we know that the udder of a non-pregnant animal may be heavily charged with them, and yet they do not give rise to sufficient anti-bodies to prevent the infection of the foetal membranes when the animal becomes pregnant. Nor can it be due to anti-bodies against ecto-toxins produced by such organisms.

It was at one time held that an animal aborts but once, but it is now generally conceded that it may abort two or three times. It is still more probable that an infected cow may abort repeatedly, but the act of abortion being easy and the foetus small, the fact is not discovered. In such animals abortion bacilli are present in the uterus, and some of them must make their way into the general circulation; yet no appreciable immunity is set up, for the animal continues to abort. On the other hand, in those animals which carry their foetus almost to full term the organisms are extremely plentiful, and in many instances the uterus contains a purulent mass of living and dead bacilli. It is possible that by the disintegration of these organisms endo-toxins are liberated and are absorbed, and that these may be the principal factor in setting up immunity.

That the *B. abortus* contains endo-toxins was shown by Stockman and McFadyean and formed the basis of their "abortin," which gives rise to a temperature re-action in an infected animal, and in some instances causes quite alarming symptoms. It was on the hypothesis that the endo-toxins were the cause of the immunity, whether in natural conditions or artificially produced, that the writer replaced the dead vaccine which he first issued by one in which the organisms were de-vitalised but their toxins remained intact. After many experiments it was decided to use chloroform for this purpose, which, according to the researches of Duval and Harris in connection with Pfeiffer's bacillus, "de-vitalises the bacilli by rapidly absorbing the water, and in consequence increasing the permeability, which results

first in plasmolysis, then rupture of the bacterial cell, liberating without affecting in any manner its toxic moiety."

In his address at the University of Pennsylvania, 28th February, 1922, Schroeder referred to the necessity for carefully *timing* protective injections of abortion bacilli. "It is reasonable," he said, "to believe that either large or repeated doses are required to secure an effective immunity. And if we bear in mind that the induced immunity must last throughout nearly the whole period of gestation, or must not be too passive or short-lived, we will understand why better results are obtained with live and virulent than with attenuated and dead cultures." On the other hand, it is almost impossible to "time" the live vaccine in herds where the commencement of pregnancy is an unknown factor. Even in heifer herds under range conditions, and where the bull is not put in until the vaccination has been performed, the service period may extend over a number of months. But in mixed herds made up of heifers and cows with which the bull has been running, the use of the live vaccine—that is, one which is virulent—is too dangerous owing to the fear of accidentally inoculating pregnant cows or of occasionally infecting non-pregnant animals, which later may abort and so set up a new focus of infection. How much more dangerous, therefore, would it be to repeat or "time" repeated inoculations! But from Bevan's early experiments it appeared that even large quantities of live vaccine, that is, emulsion made up of virulent bacilli, did not give rise to an agglutination re-action extending over a period of nine months, and it was obvious that, since a second dose could not be given during pregnancy, there must be a period during gestation when there was no immunity and the animal was vulnerable to natural infection. "Timing," therefore, has always been a feature of his vaccine treatment, and the "de-vitalised" vaccine is applied at such intervals and in such doses that an appreciable agglutination re-action is maintained throughout the whole period of pregnancy. In this connection it may be mentioned that so far as the experience of the district veterinary surgeons goes, no untoward effect follows the inoculation of healthy pregnant cows with this vaccine. It is true that in some cases complaints have been made that abortions have followed treatment, but these have generally been in outbreaks detected by the pipette method with the first or early abortions, and a considerable number of infected cows carrying dead calves or damaged membranes naturally abort whether inoculated or not. But if abortions were caused by the vaccine the results all over the country where some hundreds of thousands of doses have been applied to pregnant animals without discrimination would have been disastrous. Apart from field observations, laboratory tests show that the organism in the vaccine is quite incapable of growth either in the most favourable medium or small laboratory animals.

The immediate effect upon inoculated animals is sometimes remarkable. In some which have been barren for as many as four years, after the first inoculation the vulva has relaxed and a vaginal discharge has preceded the evacuation of a small foetus, which probably has been retained *in utero* for a long time. After which the cows

have returned to the bull and, becoming pregnant, have brought forth healthy calves. This observation encourages the hope that the vaccine treatment may help to clear up "carriers," which undoubtedly are the principal factors in the perpetuation of the disease.

Attention was drawn by one cattle inspector to the effect of the vaccine upon certain infected milch cows, whose udders became "inflamed" (*sic*) so that the yield of milk was reduced for several days. The district veterinary surgeon, Gwelo, has also observed:—

"... the most striking feature in the table is that when vaccination was completed abortions practically ceased, showing the vaccine may have some curative action in infected cases where the foetus is not dead."

Another danger associated with the live vaccine to which attention has been drawn by Schroeder is that the strains of *B. abortus* vary considerably in virulence, he and his fellow worker, Cotton, having chanced upon a strain infective for swine as well as cattle:—

"This must be looked upon as quite important when we know that sows, as a rule, are strongly resistant against strains of abortion bacilli isolated from outbreaks of abortion among cattle."

He adds:—

"How about using strains of the abortion bacillus in the preparation of suspensions of mixed strains for the protective injection of cattle, like the described swine strains? Would it be fostering and facilitating the spread of a super- or multi-virulent kind of bovine infectious abortion that causes serious losses alike among swine and cattle?"

Such a warning should surely give pause to those who are willing to accept the responsibility of advising the use of a live vaccine. The so-called "de-vitalised vaccine" is free from this danger, and if its practical results were only half as good as those claimed for the live vaccine it would be better to use it than one associated with such serious risks. How much more so when the practical results by those using it have in the past proved entirely satisfactory!

The extreme delicacy of the *B. abortus* renders it very susceptible to alterations, so that a live vaccine requires to be applied within a very few hours after preparation. This is as a rule impossible under the conditions of this country, and if it is applied after such changes have taken place it is no longer a "live" vaccine in the true sense of the word. Therefore if it is not what it is supposed to be there is no excuse for using it. On the other hand, the results of the de-vitalised vaccine are now a matter of many years' experience in this country and justify the substitution of it for the live vaccine, which, if alive, must be admitted is "as dangerous as a loaded gun in the hands of a monkey."

When in 1915 the dead vaccine was first issued in this country it was not so much for any particular merits it was thought to possess, but because the prospect of treatment acted as an incentive to owners of infected herds to report and thereby give the administrative side

of the Veterinary Department a knowledge of the distribution of the disease and an opportunity of applying prophylactic measures. It came almost as a surprise when those who employed this vaccine spoke most favourably of it, and the demand in consequence increased. Encouraged by these results, and realising the shortcomings of the dead vaccine, it was sought to improve upon it, and on the principles previously explained the so-called "de-vitalised" vaccine was evolved. In his annual report for the year 1920 the Chief Veterinary Surgeon wrote:—

"The Government Veterinary Bacteriologist, in his report for the year under review, deals fully with the subject and particularly with the results obtained by the use of a 'de-vitalised' vaccine. *These are most satisfactory*, and will no doubt be criticised by those who hold that none but a 'live' vaccine can give any degree of immunity. We, at any rate, and also the stock owners in whose herds it has been applied, are satisfied and content to carry on with it until a better is available."

The unanimous approval of the members of the veterinary profession, as expressed at the scientific meetings in 1920 and 1921, resulting in legislative measures based upon its application, was a further tribute to its efficacy. Nevertheless, it has to be admitted that its use is largely empirical, being based upon field results, and that careful experiments under strict supervision are necessary to place this vaccine upon a basis of scientific accuracy.

RESUME.

It has been known since 1913 that specific infectious abortion of cattle caused by an organism indistinguishable by cultural and serological tests from the *B. abortus* of Bang causing abortion in Great Britain, the Union of South Africa and British East Africa exists in Southern Rhodesia.

The optimistic forecasts then expressed as to the importance of the disease under the conditions peculiar to this country having proved misleading, the disease is now widely disseminated throughout Southern Rhodesia in native- and European-owned cattle, giving rise to sterility, a shortage of calves and more rarely to a large number of detected abortions in the herds affected.

Owing to the peculiarly insidious nature of the disease, and the difficulty of imposing administrative measures of control, other means had to be devised for coping with it. The first advance was the simplification of the method of collecting blood for the agglutination test by a simple contrivance which enabled veterinarians and stock owners to send to the laboratory samples of blood in a condition suitable for the test, thus enabling the disease to be detected with the first few cases of abortion and prophylactic measures to be adopted at an early stage in the outbreak.

In order to encourage owners of infected herds to report, and to afford the administrative side of the Veterinary Department the opportunity of dealing with the disease, it was thought desirable to

issue a vaccine. The live vaccine being too dangerous to issue, owing to the risk of disseminating infection by the breaking of a bottle in transit or spilling during the operation, and the possibility of setting up infection in pregnant animals inoculated in error, or non-pregnant animals which occasionally may be infected, it became necessary to issue a "dead" vaccine composed of organisms destroyed by heat.

The results obtained by this vaccine were considered highly satisfactory, not only by the owners of infected herds, but by the district veterinary surgeons, and led to a large demand. These unexpected results encouraged further research with a view to improving the method of preparation in such a way as to de-vitalise the organism, or render it impossible of further growth while still retaining its integral properties, toxins, etc., to afford that stimulus necessary for the production of specific immunity.

It was believed that the principal factor in the production of that immunity which it set up in certain circumstances under natural conditions was the endo-toxins liberated by the disintegration of the organisms, and in preparing a vaccine it was sought to preserve these intact. In this manner the so-called "de-vitalised" vaccine was evolved, and proved so successful in practice that the demand compelled its continued and increasing production.

After five years' practical experience in the field the members of the veterinary profession at two scientific meetings approved its continued use, and the administrative side based its regulations upon its application. These measures have met with most satisfactory results, and although new centres of infection are reported almost daily, old centres have been cleared up. For example, the Marandellas district, at one time one of the original and worst infected areas, appears to be almost free from infection.

There would therefore appear no necessity to resort to the use of the "live" vaccine, which, if alive in the sense that it is virulent or pathogenic, is dangerous not only to cattle, but possibly to man, and if not virulent—and recent reports show that the large majority of so-called "live" vaccines are not—offers no advantages over the "de-vitalised" vaccine.

Nevertheless, it is recognised that the latter is somewhat empirical, in that its use is based upon field experience, and that careful experiments under the strictest supervision are necessary to place it and other vaccines presumed to possess therapeutic virtues upon a basis of scientific accuracy.

Insect Pests of Fruits other than Citrus in Southern Rhodesia.

By RUPERT W. JACK, F.E.S., Chief Entomologist.

The cultivation of fruits other than citrus has not as yet assumed great importance in Southern Rhodesia. This fact is not altogether due to lack of a suitable climate. Whilst it is true that the summer rainfall militates against the establishment of an industry in such fruits as figs and grapes, and that we cannot hope to raise peaches to compare with the quality of those which grow to perfection in the Western Province of the Cape, there are none the less certain species which grow well in different parts of the Territory, and their limited culture at the present time is due rather to the lack of extensive local markets than to any inherent disability of the country to produce such fruit in quantity. As is well known to all residents, apples of excellent quality are raised in moist elevated situations along our eastern border and certain varieties of sufficient quality for local consumption are grown elsewhere. Japanese plums thrive well and a limited variety of peaches and apricots is produced. Other fruits which do well enough in the Territory include guavas, loquats, mangoes, grenadillas, strawberries, pawpaws, plantains, pomegranates, etc. In certain situations figs flourish and produce fruit suitable for consumption in the green state. It is hoped, therefore, that the following account of the insects affecting such fruits in the Territory will not be without value.

As a general statement the trees and plants which produce these fruits, with the exception of the fig, are not seriously attacked by pests, but the same remark does not apply in all cases to the fruit itself, which is liable to be "stung" and rendered worthless by various insects. The fig is subject to more pests than other species of local fruit, and calls for considerable attention if good crops of fruit are to be secured.

INSECTS WHICH "STING" FRUIT.

♦

When the writer first took up his duties in this Territory some thirteen years ago the number of complaints of "Fruit Fly" injury received gave the impression that these pests were extremely active in this part of the world, and the *Rhodesia Agricultural Journal* for August, 1911, contains a statement to this effect. Subsequent experi-

ence has, however, demonstrated clearly that fruit flies in most parts do very little of the damage attributed to them, the real depredators being certain species of moths, mostly of moderate to large size, which pierce the fruit with their proboscides or tongues with a view to sucking up the juice. These moths will, therefore, be dealt with first of all.

Fruit-Piercing Moths.—There are six plates illustrating this article which are devoted to these insects, eighteen different species being figured. Of these some are very much commoner and therefore more destructive than others, but all of them have similar feeding habits, a fact which the writer has been at some pains to establish. It does not follow because certain moths are found commonly feeding on ripe broken fruit that they have the ability to pierce the skin in the first place and so cause primary injury. An examination of the laden peach and plum trees during January and February after dark commonly reveals a wide variety of moths feeding on the juices of the fruits, which have been broken by fruit-eating beetles and other agents, and many of these appear to be quite innocuous as far as injuring sound fruit is concerned. Cutworm moths of the genera *Euxoa* and *Agrotis* are very commonly seen, as also are the large moths belonging to the genus *Cylogramma*. The latter have been suspected of piercing sound fruit for a long time, but according to observations made at Salisbury they do not appear to do so. Most of the common species of *Noctuid* moths are met with on broken fruits when these are examined by night during January and February.

Now it might be supposed that moths having the capacity to pierce the rinds of fruit would have their proboscides or tongues modified for this purpose, for it must be borne in mind that this organ in the vast majority of butterflies and moths is simply used for sucking honey from flowers and imbibing other liquids of an attractive nature. It is in fact merely a weak tube, of somewhat complex structure, and not a piercing instrument at all. The curious fact is, however, that whilst in certain species of fruit-piercing habit the proboscis is considerably modified, being provided with a sharp horny tip, well adapted for boring purposes, in others the structure does not apparently differ in any essential particular from that of the numerous species which do not pierce fruit. On Plate IV. are shown photo-micrographs of the tip of the proboscis in eight different species of common fruit-piercing moths, and the difference in structure can clearly be seen. It may be stated that the species with a special boring apparatus are mostly known to pierce citrus in addition to the thin-skinned fruits, a proceeding of which the species with an unmodified proboscis are apparently incapable. The species with a modified proboscis which have so far been recorded in the Territory are as follows:—

• *Fruit-piercing moths with a specially modified proboscis*—

- (1) *Othreis (Ophideres) materna*, Linn.
- (2) *O. fullonica*, Linn.
- (3) *O. divitiosa*, Wlk.
- (4) *Calpe provocans*, Wlk.
- (5) *C. triobliqua*, Saalm.

- (6) *C. emarginata*, F.
- (7) *Serrodus inara*, Cram.
- (8) *Pericyma* (Homoptera) *umbrina*, Guen.

These may now be considered in more detail:—

(a) *Moths of the genus Othreis* (Plates I. and IV.).—These are large handsome moths with bright yellow underwings bordered, and in two out of the three local species spotted, with black. *O. materna* is perhaps the commonest of the three, but *fullonica* is nearly, if not quite, as common. *O. divitiosa* has the hindwings without black spots and is something of a rarity at Salisbury, though Mr. R. L. Thompson, late of this branch, reported it as abundant in the Amatongas forest in February. Curiously enough, *fullonica* is not recorded in Mr. Janse's "Check List of South African *Lepidoptera-Hetero cera*." Both this species and *materna* occur through India and the East Indies to Australia. In the latter continent they were first recorded as attacking oranges.

In spite of considerable effort the caterpillars of these moths have not been found in Southern Rhodesia. They are known to feed in Australia (and *materna* in Natal) on certain creepers belonging to the family *Menispermaceæ*, the recorded genera being *Cocculus*, *Stephania*, *Tinospora* (?) and *Desmonema*. Of these *Cocculus*, *Stephania* and *Desmonema* are found in Africa, but only the first-named has as yet been reported from this Territory. Other Southern Rhodesia representatives of the family are *Cissampelos*, *Tiliacora* and *Dioscoreophyllum*.

The caterpillars of these moths are nocturnal in habit, and although large and conspicuously coloured, are seldom seen. Through the courtesy of Mr. E. E. Platt, of Durban, Natal, the writer is in possession of two inflated and mounted specimens of the larvæ of *materna*. These caterpillars measure about 2½ ins. in length and are smooth and cylindrical, except for a conspicuous hump near the hind end of the body. The front pair of the false legs are obsolescent. In the one the ground colour is a deep velvety black, but the second specimen is light brown. On the dorsal part of the sixth and seventh segments are two pairs of eye-like spots, which in the black specimen have a black centre surrounded by a circle of lighter colour, three-quarters of which is red and the remaining quarter light yellow. The eye-like appearance is enhanced by a narrow yellow crescent in the lower part of the central spot. The remainder of the body in this specimen is flecked with light yellow and the dorsal part of the segments in front of the eye spots with red. The other specimen is more or less uniform brown, except for the eye spots, which contain black and yellow. The coloration of these caterpillars is said to vary considerably, and that of *fullonica*, which is described and figured by Henry Tryon, *Queensland Agricultural Journal*, April, 1898, apparently does not differ very greatly from that of *materna*.

The caterpillar is stated in Australia (T. Batcheler, quoted by Tryon) to become full-fed about three weeks after hatching from the egg. It then fastens together adjacent leaves of its food plant, and

within this shelter spins a very delicate cocoon of white silk, attaches itself by its "tail end" and passes into the pupa stage, from which the moth is stated to emerge about three weeks later. These observations presumably apply to summer temperatures. The life cycle has apparently not been followed throughout the year, but it is suggested that the winter is passed in the adult stage, the over-wintering females laying eggs in the spring. As the females would naturally be exposed to considerable reduction in numbers during the winter months, the first brood might be expected to be a small one. The main brood in Southern Rhodesia appears in January, when freshly emerged specimens are abundant in favourable seasons on the ripening peaches and plums. Their depredations continue, however, throughout the wet season, early Navel oranges suffering, sometimes severely, in March and April.

(b) *Moths of the genus Calpe* (Plates III. and IV.).—Although moths of this genus occur elsewhere in South Africa, they do not appear to have attracted attention further south in relation to their fruit-piercing habits. They do, however, pierce both citrus and thinner-skinned fruits, and *C. provocans* at least is sufficiently common to be considered. The sharp modified proboscis of this species is shown on Plate IV.

In *C. provocans* the forewings are deep reddish brown, with a metallic bronze patch towards the outer margin and a similar oblique stripe about the middle of the wing, terminating in the downward angular projection to be seen in the photograph. There is a small silver dash close to the centre top angle in both sexes, and in the female an additional similar mark towards the lower (inner) margin of the wing. The specimen figured is a female. The hindwings are dull brown, darker towards the outer margins. *C. emarginata* has the forewings pale brown and the hindwings cream coloured, more or less suffused with brown. *C. triobliqua* has the forewings marbled with dark greenish brown on a paler ground and a characteristic pale stripe running from near the inner angle of the wing towards the outer margin nearly parallel with the lower (inner) margin. In all three species the front part of the thorax and the head are bright yellow, speckled with vermilion, though these colours are rather faded in the older specimens.

Probably all three species feed in the caterpillar stage on similar plants, but the larvæ have not been discovered as yet in Southern Rhodesia. Mr. Platt supplies the following food plants for *provocans*, namely, *Cissampelos torulosa*, E.M. (*Menispermaceæ*) and *Ophiocaulon gummifera*, Hkf. (*Passifloraceæ*). *C. emarginata* is also recorded from *Stephania discolor*, Spring, in addition to the two plants given for *provocans*. The caterpillar of *triobliqua* has apparently not been recorded.

The adults of *provocans* in the collection at Salisbury were taken over a range of months from January to April, and in September, *emarginata* in February and September, and *triobliqua* from February to April.

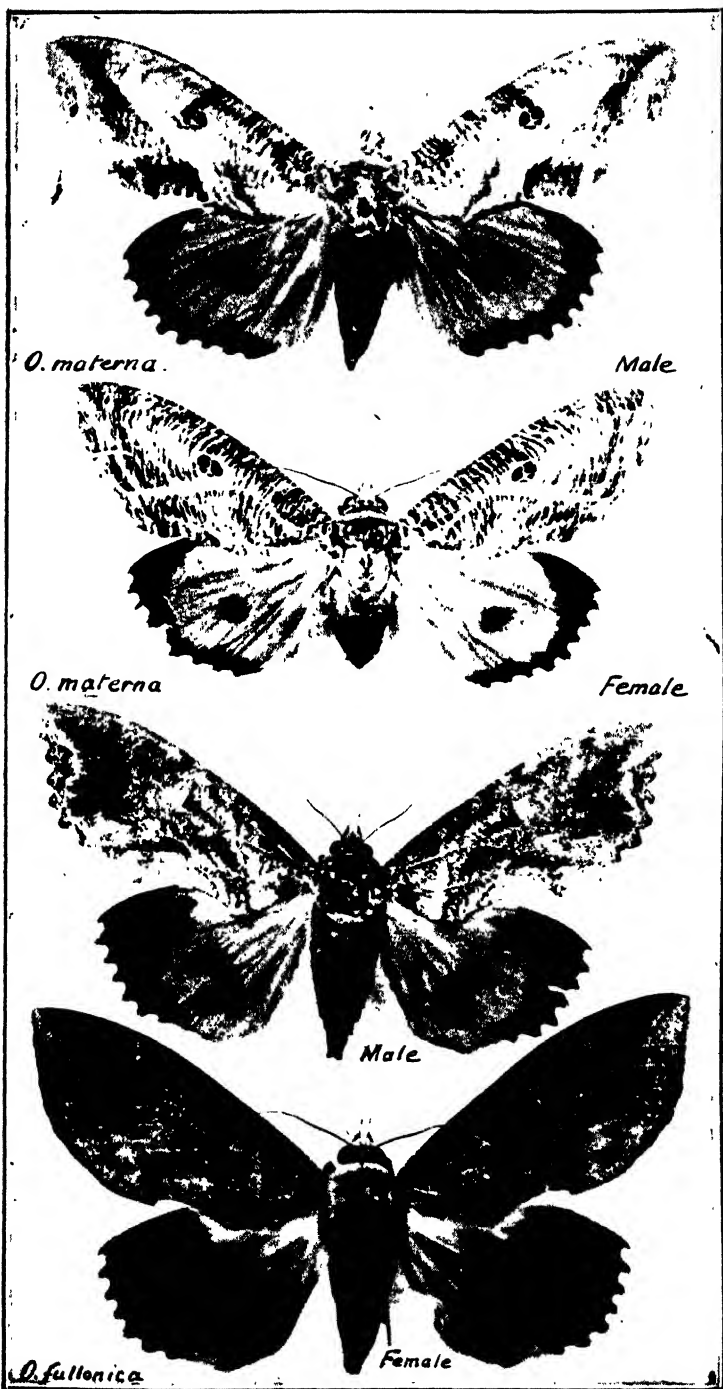


Plate I. Fruit-piercing moths.

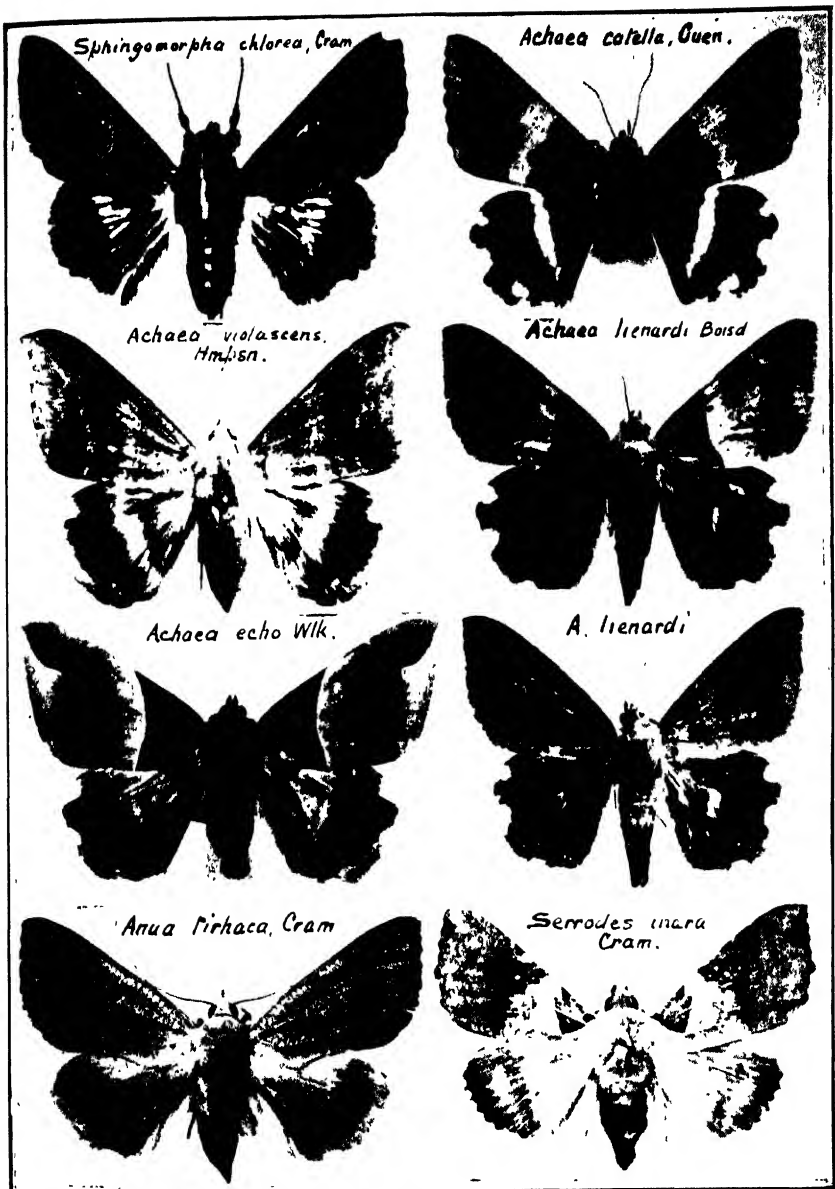


Plate II. Fruit piercing moths.

(c) *Serrodes inara* (Plates II. and IV.).—This species has long been known as fruit-piercer at the Cape, and although I have not been able to obtain a copy of the paper, it is probably the species of which the proboscis was described by a Mr. McIntyre in the *Monthly Microscopic Journal* of May, 1874, the reference being given by Tryon (*loc. cit.*). The species, although no rarity, is not particularly abundant in the Territory. The shape of the proboscis suggests an ability to pierce thick-skinned fruits, such as citrus, but it has not yet been observed to do so in Southern Rhodesia.

The caterpillar is not known to the writer, but Platt gives *Sapindus oblongifolius*, Sond., as a food plant. This plant is a coast species and not known to occur in this Territory.

(d) *Pericyma umbrina** (Plates III. and IV.).—This little moth was first observed by Mr. R. L. Thompson piercing the rind of hard quinces near Umtali in February, 1916, and a subsequent examination of the proboscis (see Plate IV.) did not lead the writer to express any doubts as to the correctness of the report. This species, as well as the closely allied *P. glaucinans*, occurs in India, and although well known to entomologists, there does not appear to be considered a pest of fruit.

The caterpillar has been taken at Salisbury feeding on *Acacia* sp. A detailed description was unfortunately not made, but it is a slender green semilooper, i.e., the first two false legs are much reduced. There are some white zig-zag markings along the sides.

The moths, in addition to quinces in February, have been taken on loquats and guavas in April and on Japanese plums in January and February. The adults have been taken from December to May, and in September. The markings on the wings vary considerably, but consist of a number of dark brown wavy lines or bands on a lighter brown ground.

It is a noteworthy fact that with the present exception all the moths recorded to date as of fruit-piercing habit, which have a definitely modified proboscis, belong to the same sub-family (*Noctuina*), whereas those of the sub-family *Catocalina*, to which the present species, although numerous in species, belong, possess proboscides of an apparently normal type. There are four other species of *Pericyma* recorded in South Africa by Janse, and presumably they would not differ from *umbrina* in the form of this organ. There is indeed a second unidentified species in the collection taken on a plum which has a proboscis similar to *umbrina* and is presumably a fruit-piercer.

The species of fruit-piercing moths which lack any definite modification of the proboscis so far recorded in the Territory are as follows:

* The Imperial Bureau of Entomology must take the responsibility for the identity of this insect. It appears very unlike the only figure of *umbrina* in the office library, namely, that in Lefroy's *Indian Insect Life*.

Fruit-piercing moths with an unmodified proboscis—

- (1) *Anua tirhaca*, Cram.
- (2) *Achæa catella*, Guen.
- (3) „ *violascens*, Hmps.
- (4) „ *lienardi*, Boisd.
- (5) „ *echo*, Wlk.
- (6) „ *finita*, Guen.
- (7) „ *sordida*, Wlk.
- (8) „ *albicilia*, Butl.
- (9) „ *trapezoides*, Guen.
- (10) *Sphingomorpha chlorea*, Cram.

(a) *Anua tirhaca*, Cram. (Plates II., IV. and V.).—This is a common species, occurring through to the Cape, where its fruit-piercing habits have long been recognised. It also occurs in India. The coloration of the wings is a pale yellowish green, with a broad light-brown band along the outer margin and two brown spots. The hind-wing is buff yellow with a black band.

The caterpillar of this species is unusually large, relative to the size of the moths. A specimen photographed from life is shown at its natural size on Plate V. The general coloration is light brown and the cryptic appearance of the insect is well indicated in this photograph. Full grown specimens measure up to $3\frac{1}{2}$ ins. in length. It has a considerable range of food plants. At Salisbury it has been found on *Geranium* and *Guava* (also recorded as a food plant in India). At Capetown the writer bred a specimen from *Australian Myrtle* (*Leptospermum lauratum*). Platt gives in addition *Rhus villosa* and *R. laurata*, as well as *Combretum guenzii*, all of which plants occur in this Territory.

(b) *Moths of the genus Achæa* (Plates II., III., IV. and V.).—This genus includes some of the most important enemies of soft fruits. *A. catella*, Guen., is one of the commonest at Salisbury. This is a handsome species, the markings of which are, however, somewhat variable, more particularly in respect to the light grey band on the forewings which is frequently wanting. The markings on the forewings consist of greys and browns; the hindwings are deep brown, with white markings, and in fresh specimens are suffused with a bluish tinge. The caterpillar is grey green, with a darker mark down the back and a conspicuous yellow spot on either cheek. There is also a black mark across the back near the fore end, with three light spots behind it and a black double-pointed projection near the "tail end." It is most commonly found on castor oil (*Ricinus*), but we have also taken it freely on *Bauhinia reticulata* at Salisbury, and the specimen figured on Plate V. is feeding on this plant. Other food plants recorded at Salisbury include *Cabbage* and *Bottle-brush* (*Callistemon*). *Burkea africana*, *Rose*, *Euphorbia* and *Eucalyptus* are recorded elsewhere, the first-named by Mr. Munro, of the Division of Entomology, Pretoria, and the last three by the late Mr. C. B. Simpson, formerly Entomologist to the Transvaal Government.

Another common species is *A. licnardi*, Boisd., also a well known fruit-piercer at the Cape. This species sometimes out-numbers all its fellow robbers, but is sporadic to a marked degree. The variety in the markings of the forewings is almost infinite, and out of a series of over fifty specimens in the collection there are hardly two alike. The markings of some of them approximate rather closely to those of *echo*, figured on the same plate. The forewing markings consist of cryptic browns, which frequently have a greenish tinge. The hindwings are brown, suffused with blue in fresh specimens, and spotted with white at the edges. There is also a remnant of the white band which is much more fully developed in *catella*.

A. violascens is a species which was described by Sir George Hampson from specimens bred out at Salisbury. It has not been recorded from elsewhere, but is common enough in the vicinity of the capital. The colour of the forewings is mainly russet, with a purplish suffusion and some greenish bands. Towards the outer margin is an area of dove grey. The hindwings are deep brown outside the white band and lighter brown within; the white spots on the margin are to some extent confluent.

The caterpillar photographed from life and shown on Plate V. is brown to the naked eye and has much the appearance of a dead twig. Under the lens the colour is seen to consist of an indescribably intricate arrangement of dove grey, dark brown and orange, the brown and orange being stippled on the lighter ground, which is reduced to thin lines bordering the darker spots. The most striking characteristic is, however, revealed when the insect is alarmed and bends the head under the body. In the photograph a hump will be seen towards the front end of the body, and when the body is bent at this point a brilliant orange gash is revealed, and stronger flexure reveals a smaller similar gash behind the larger one. (The front gash is really between what are known as the first and second abdominal segments, and the hind one between the second and third.) These caterpillars attain a length of two and four-fifths ins. They feed on *Protea* and on another Proteaceous plant, namely, *Faurca speciosa*, Welw.

The remaining species of *Achæa* call for little comment. *A. echo* is a handsome species with forewings marked with deep brown on a purplish brown ground. *A. finita*, *A. albicilia* and *A. sordida* are dull brown species which greatly resemble each other, and *A. trapezoides* is not much handsomer, having forewings drab or greenish brown, with some thin darker and paler lines. The food plants of the caterpillars as far as known are given in the attached list. *A. finita*, *A. sordida* and *A. trapezoides* have been bred out at Salisbury from full-fed caterpillars found wandering over the ground, apparently seeking a suitable spot for spinning up. The larva of *finita* was of an almost uniform bluish green colour; that of *sordida* was brown, smooth and not unlike a faded edition of *catella*, but lacking the yellow spot on the cheek; the caterpillar which proved to be *trapezoides* was very similar to that of *sordida*, but the yellow cheek spots of *catella* were faintly indicated. The specimen of *trapezoides* probably came from castor oil nearby, but the *finita* certainly did not, and the species

must have some other food plant. Similarly the *sordida* could not have been feeding on *Calpurnia*.

The moths of the genus *Achæa*, as far as Rhodesian experience indicates, spin up when about to pupate in a weak cocoon in folded leaves of the food plant, the pupal period lasting about three weeks. Attempts to obtain fertile eggs in confinement have uniformly failed, and the complete life history is therefore unknown, but there are undoubtedly several broods during the year. Caterpillars of *catella* have been collected in December, January and February, and moths from November to April. *A. violascens* adults have been taken or bred out from January to March only. *A. echo* is commonly taken in houses during the winter (May and June), and probably hibernates in the adult stage, as other species may also do. The one specimen of *finita* emerged on the 26th April, indicating a late brood, whilst both *sordida* and *trapezoides* emerged in March, presumably a brood following the usually abundant January emergence.

Some species of *Achæa* appear to be largely nocturnal or crepuscular in the larval stage. This appears to be the case with *catella*, but the caterpillars of *violascens* were collected freely during the day time.

(c) *Sphingomorpha chlorea*.—The last species to be dealt with is possibly the most important as far as soft fruits are concerned. This is one of the commonest of our larger moths and often enters houses, although apparently not much attracted nor confused by light. The moth is easily recognised by its brown marbled forewings, pale brown hindwings, with a darker band towards the margin, and the pale stripe down the middle of its back. A second species, *S. marshalli*, Hmps. n., is recorded from Umtali, but is unfamiliar to the writer and its habits are unknown.

Notwithstanding the abundant occurrence of *S. chlorea*, the caterpillars are not easily found, owing to their strictly nocturnal habit. The moth is common in the Union of South Africa, and the only food plants recorded there appear to be various species of *Acacia*. The caterpillars appear to hide in crevices during the day, ascending the trees after sundown for the purpose of feeding. The writer has only once seen the caterpillars alive. This occurred shortly after dark on a close thundery evening in November. The writer was camping on the banks of the Umniati River and was suddenly interested to see in the light of the acetylene lamp a number of large caterpillars proceeding rapidly with a looping gait up the stem of a tree. There were about a dozen of them, and they seemed to be in a great hurry. The tree proved to be *Diplorrhynchus mossambicensis*, Benth., well known to local natives under the name of "Mtowa." The natives also stated that the caterpillars were an article of food with them and bore the name "Nowa." The next day in travelling back towards the railway line a number of these trees were noted and most of them had been considerably defoliated, according to the natives, by the same caterpillar. From the specimens collected, adults of *S. chlorea* emerged at Salisbury. The Mtowa tree belongs to the family *Apocynaceæ*, and has a white latex. It is common enough in the sand



Achaea finita Guen.



Achaea sordida,
Wlk.



Achaea albiulia Butt.



Achaea trapezoides Guen.



Calpe emarginata, F.



Calpe triobliqua Saalm.



Calpe provocans Wlk.



Pericyma umbrina Guen.

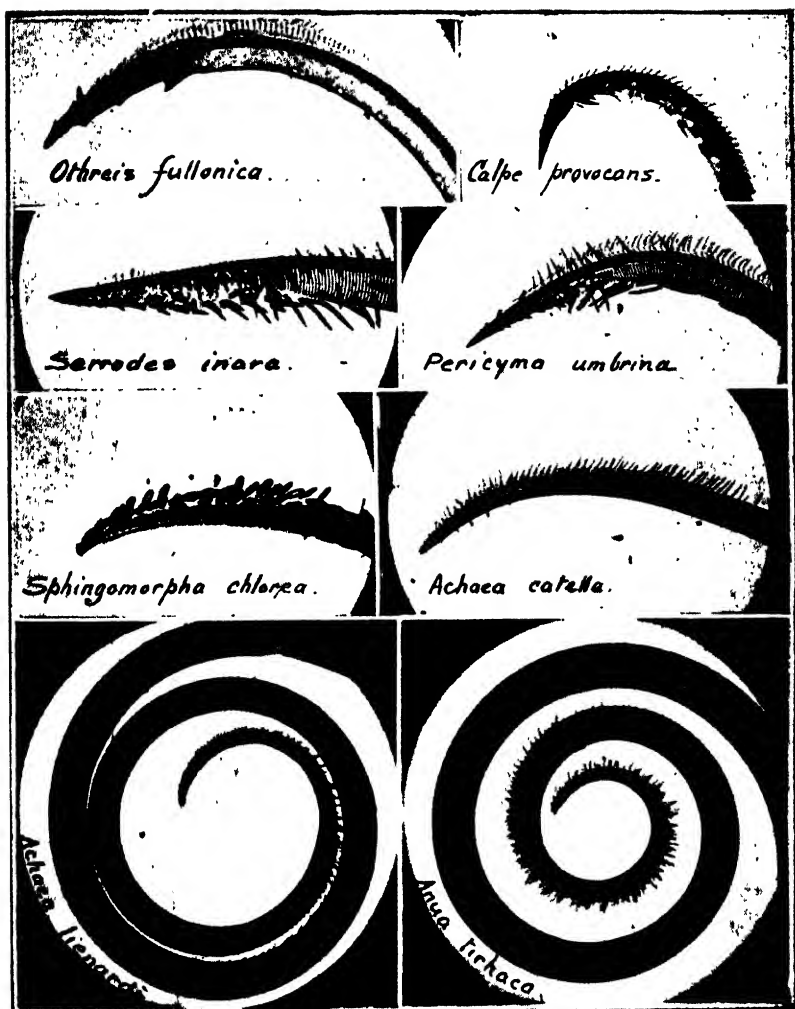


Plate IV. Proboscides of fruit-piercing moths, greatly magnified.



Plate V. Caterpillars of three species of fruit-piercing moths.

veld, but scarce around Salisbury. *Acacias* are also not common on the diorite and banded ironstone, and in view of the general distribution and abundance of the moth, some other food plant is indicated, but this remains to be discovered.

The caterpillars are smooth and indifferently green or brown. Although they move with a looping gait, all four pairs of false legs are fully developed. Miss Frances Barrett, of Buntingville, in the Transkei, originally described these caterpillars in a letter to Mr. C. P. Lounsbury, Government Entomologist at Capetown, in 1903. Her letter was published in the *Cape Agricultural Journal* for January of that year. Whilst describing the caterpillars as either green or brown, she mentioned a "regular pattern in white markings like lace over the green, and a patch of crimson on what might be called its shoulders." The writer was pressed for time when the specimens mentioned were collected and did not write a description from the living insects. The patch on the back between the first and second abdominal segments is orange with a deep black border in the preserved specimens available, but may very likely have been crimson in life. The white markings like lace are also only faintly indicated in indistinct lighter lines on the ground colour. It is curious to note that the bright coloured gash on the back should occur in both *Achæa violascens* and *Sphingomorpha chlorea*, both of which have similar habits in the adult stage, yet belong to different sub-families. The larva of *S. chlorea*, in fact, very much suggests that of an *Achæa*.

Notes on Fruit-Piercing Moths in General.—The injury caused by the feeding habits of fruit-piercing moths is mainly due to the results which almost inevitably follow perforation of the protective skin of the fruit. A certain amount of the juice is, of course, absorbed, but the ingress of air naturally admits of oxidation of the juice close to the perforation, and micro-organisms causing fermentation and decay are either introduced with the proboscis of the moth or gain an entrance later. The consequence is first local decay, then dropping of the fruit, followed by rapid complete rotting. Commonly, if the fruit ferments, the so-called "Pomace Flies" (*Drosophilidæ*) lay their eggs in the pulp and infest the spot with small maggots, which are sometimes mistaken for those of the true fruit flies (*Trypaneidæ*), to be dealt with later.

The moths come to the fruit about dusk and continue feeding at least till late in the night. Fruits in a particularly attractive condition as regards ripeness are frequently attacked by several moths at the same time, and a scene such as that depicted on Plate VI. is very commonly disclosed by the lantern. As many as six moths of different species have in fact been seen at a single fruit. The moths attack injured and sound fruit indiscriminately, and are not at all averse to fruit which has commenced to ferment. In point of fact, alcohol is distinctly attractive to at least one species, namely,

Sphingomorpha chlorea.—This moth, after entering a lighted room, will fly around without becoming confused by the light. The writer has noticed that the moth has a tendency to swoop down and

hover round a glass of whisky or brandy and water, and has even found them sitting on the cork of a bottle of one or other of these beverages. On one occasion a specimen was induced to insert its proboscis into a tumbler of whisky and water. It apparently drank for a few seconds, but took fright and left before indicating whether it really liked the stimulant or not. It is possible that the fumes of alcohol may lead the moth to anticipate the presence of sweet fermenting fruit juice, as alcohol is, of course, not found in an approximately pure state in nature, and the insect could thus have no excuse for developing such a degraded taste!

The abundance or otherwise of fruit-piercing moths varies greatly from year to year. As a general statement, years of abundance usually affect all species. A period of phenomenal abundance occurred at Salisbury in January, 1915, which will be remembered as a very wet summer following several years of short rainfall. There was a big brood of *Achaea lienardi* during the month, the moths, obviously newly emerged, putting in an appearance suddenly in great numbers after most other species had been at work for nearly a fortnight.

The moths attacked the early peaches, "Wickson" and other Japanese plums, as well as figs very freely, but apparently did not care for the slightly bitter "Willow" peaches, of which many trees were present in the locality. Later, the harder yellow canning peaches, known, it is believed, as the "Old Cape Yellow," were much affected. Apples in the same orchard received little attention, although this fruit is attacked in the absence of other attractions. In April guavas constitute the chief attraction, and at this time early "Navel" oranges may be attacked by such species as are able to feed on these thick-skinned fruits.

Control Measures.—Owing to the wide range of native plants on which the caterpillars of the numerous species feed, comparatively little can be done in the way of checking the breeding of the moths, which undoubtedly fly from considerable distances to the orchards. In point of fact, too little is known concerning these food plants at the present time. The comparative abundance of the species of *Othreis* is difficult to reconcile with the relative scarcity of the known food plants of the family *Menispermaceæ* about Salisbury, and it appears probable that these moths have a food plant of some other family which should be of much freer occurrence. Again, *Sphingomorpha chlorea* is abundant everywhere, even miles away from any trees, either *Acacia* or *Diplorrhynchus*, and a careful and somewhat frequent examination of isolated clumps of *Acacia* close to orchards much frequented by the moth has so far failed to reveal any caterpillars. Another food plant is, therefore, indicated for this species, and without doubt the range of food plants known in connection with most of the common species will be greatly augmented with the passage of time.

Failing the practicability of attack on the larval stages of these pests, the question resolves itself into that of protecting the fruit from the attack of the moths.

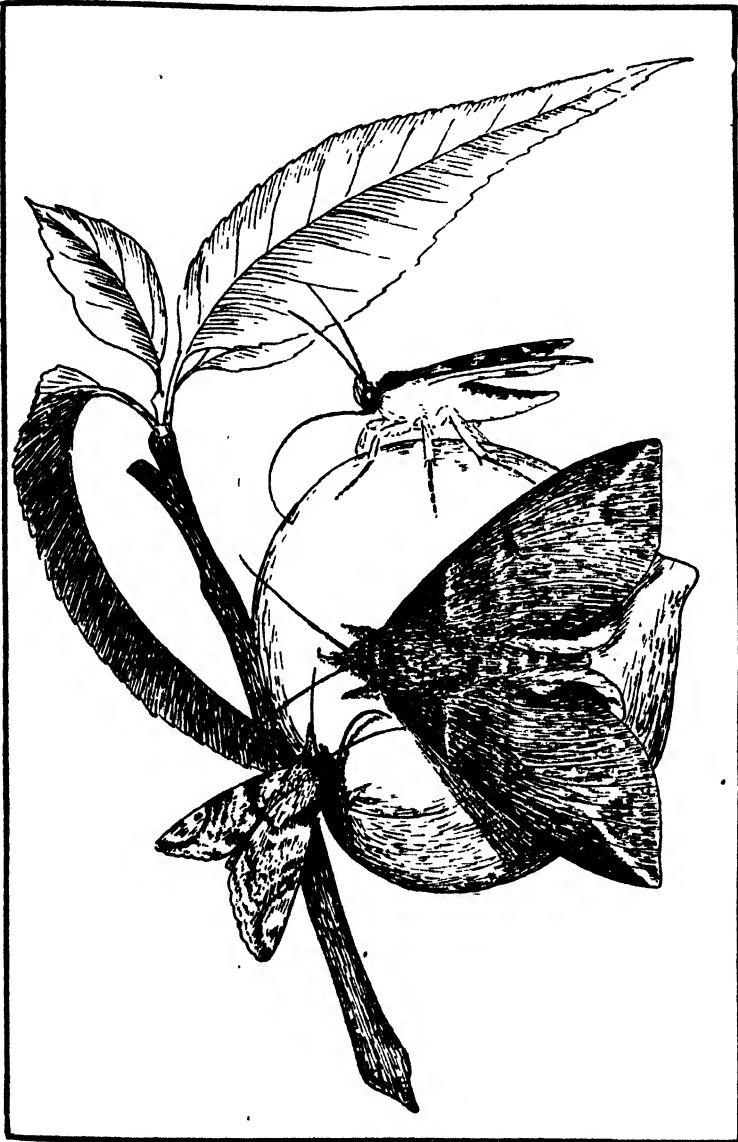


Plate VI. Fruit-piercing moths attacking a peach.

In the case of some of the Japanese plums and other fruits which will ripen satisfactorily indoors, the fruit can mostly be saved by picking it while still green, as it is rarely attacked in this stage in the orchard. Clean open cultivation in the orchard, involving the removal of lurking places for the moths during the day time, appears to act to some extent as a deterrent. Certainly the worst attacks in the writer's experience have been in respect to trees which have been surrounded by shrubs, long grass and other weeds in neglected gardens and small private orchards.

Enclosing the trees in a cheap grade of mosquito netting is commonly practised, and, of course, if the netting is free from holes and tied tightly round the trunks of the trees, mechanical exclusion is effected. Before the adoption of poisoned bait against fruit fly at the Cape, netting the trees in the case of choice varieties of peaches, etc., was considered profitable, and the method should appeal to the private owner of fruit for domestic consumption as the safest course to pursue. If taken care of, the same piece of netting should last for several seasons, especially in gardens protected from violent winds.

It is possible that something might be done with some sort of poisoned bait against fruit-piercing moths, but in view of numerous lines of research of greater importance which have occupied the time of the entomological branch, the matter has not received much attention to date.

In compiling the following list of the moths of known fruit-piercing habits in this Territory with the food plants of the larvæ so far recorded, the writer wishes to acknowledge the kind assistance of Mr. E. E. Platt, of Durban, Natal. As indicated in the table, most of the records are from Natal and some of the food plants are not known to occur in this Territory, whilst in a proportion of those which do occur the description is very limited. Perhaps some of our readers who take an interest in entomology may be able to add to the list.

FRUIT-PIERCING MOTHS: FOOD PLANTS.

Moth.	Food plant.	Family.	Natal.	Remarks re food plants.
1. <i>Othreis materna</i> , L.	<i>Desmonema caffra</i> , Meir.	Menispermaceae	?	S. R.
2. <i>O. fullonica</i> , L.		Menispermaceae		
3. <i>O. divitiosa</i> , Wlk.	?	?		
4. <i>Calpe provocans</i> , Wlk.	<i>Cissampelos torulosa</i> , E. M. <i>Ophiocaulon gummifera</i> , Hkf.	Menispermaceae Passifloraceae		Genus occurs on stream banks near Salisbury. Not known in S. R., but <i>Granadilla</i> = <i>Passiflora</i> .
5. <i>Calpe emarginata</i> , F.	<i>Cissampelos torulosa</i> , E. M. <i>Ophiocaulon gummifera</i> , Hkf.	Menispermaceae Passifloraceae		Genus occurs on stream banks near Salisbury. O. genus not known in S. R. <i>Granadilla</i> = <i>Passiflora</i> .
6. <i>Calpe triobliqua</i>	<i>Stephania discolor</i> , Spring.	Menispermaceae		Not recorded from S. R.
7. <i>Sphingomorpha chlorea</i> , Cram.	<i>Acacia hirtella</i> , E. M., etc. <i>Diplothyrsus mossambicensis</i> , Benth.	Leguminosae Apocynaceae		Probably other acacias. This = "Mrowa," widely distributed in S. R., but not common round Salisbury.
8. <i>Serrodus inara</i> , Cram.	<i>Sapindus oblongifolius</i> , Sond.	Sapindaceae		Least species only. <i>Dodonaea</i> belongs to the same family.
9. <i>Pericyma umbrina</i> , Guen.	<i>Acacia</i> sp.	Leguminosae		
10. <i>Anua tirhaca</i> , Cram.	<i>Rhus laevigata</i> , Linn. <i>Rhus villosa</i> , Lf. <i>Combretum guenzii</i> , Sond. <i>Geranium</i>	Anacardiaceae " Combretaceae Geraniaceae		Victoria. Bulawayo, Salisbury, Mazoe, etc. Khami, Matopos, Victoria Falls. Cultivated and two native sp. recorded in Melsetter and Matopos.

FRUIT-PIERCING MOTHS: FOOD PLANTS—continued.

Moth.	Food plant.	Family.	Remarks re food plants.
10. <i>Anua birbaca</i> , Cram. (con.)	Guava (<i>Psidium</i>) Australian myrtle (<i>Leptospermum</i> <i>laevigatum</i>)	Myrtaceae	Cultivated. Cultivated only in S.R.
11. <i>Achea catella</i> , Guen.	<i>Ricinus communis</i> , L. <i>Bauhinia reticulata</i> , D.C. Bottle-brush (<i>Callistemon</i>) Rose <i>Euphorbia</i> <i>Eucalyptus</i> <i>Burkea africana</i> , Hook. Cabbage	Euphorbiaceae Leguminosae Myrtaceae Rosaceae Euphorbiaceae Myrtaceae Leguminosae Cruciferae	Cultivated and naturalised. Common all over S.R. Cultivated only in S.R. Cultivated. Native. Cultivated only. Common in S.R. Cultivated.
12. <i>Achea sordida</i> , Wlk.	<i>Calpurnia lasiogynae</i> , E.M.	Leguminosae	Prob. wet primitive forest type, E. border.
13. <i>Achea finita</i> , Guen.	<i>Ricinus communis</i> , L.	Euphorbiaceae	Cultivated and naturalised.
14. <i>Achea violascens</i> , Hampson.	<i>Protea</i> sp. <i>Faurea</i> sp.	Proteaceae "	Common everywhere. Common round Salisbury.
15. <i>Achea echo</i> , Wlk.	<i>Excoecaria reticulata</i> , Mull. Arg. <i>Eugenia cordata</i> , Laws.	Euphorbiaceae Myrtaceae	Common E. border, S.R. Waterboom = <i>E. owariensis</i> ; common in wet vleis in S.R.
16. <i>Achea lieardi</i> , Boisd.	<i>Acacia</i> sp. (including wattle)	Leguminosae	Widely distributed.
17. <i>Achea trapezoides</i> , Guen.	Prob. <i>Ricinus</i>		

(To be continued.)

Bulawayo Municipal Experiment Station.

FIRST REPORT.

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist.

Thanks to the much appreciated co-operation of the Bulawayo Municipal Council, arrangements were made for the opening of this experiment station in June, 1921. The site selected lies in the vicinity of the Old Hussar Camp and is about two miles from the centre of the town. The soil is a rather shallow, red clay loam, underlain by gravel, and is of moderate but not of high natural fertility. The land had been cleaned of bush and ploughed towards the end of the rainy season of 1921 and was part of an area which the Municipality had intended to use for their own farming operations.

The original area set aside for experimental purposes was twenty acres, but for the coming season this has been increased to thirty acres. The experimental work is planned, organised and generally supervised by the officers of the Division of Agriculture and Botany, but the actual work on the plots is carried out by the employees of the Council under the capable management of the Town Ranger, Mr. Babb, whose enthusiastic and conscientious aid has largely contributed to the success of the work. Seeds and fertilisers are supplied by the Department of Agriculture and the produce of the station remains the property of the Municipality.

Owing to the fact that *breaking* had been delayed rather late in the year, the first ploughing was not too well done, and it was impossible to work the land up to a really satisfactory tilth by the time seeding and planting was commenced. In order, however, to obtain some results the first season, it was decided to adhere to the usual dates of planting rather than to delay this operation in order to better prepare the land. As things turned out, the decision was a fortunate one, for although the early rains were favourable, they were not lasting, and from the New Year onwards the drought was even more severe in Matabeleland than in other parts.

During the early part of the season there was no rain gauge on the station and one could not be supplied until the rains had ceased.

An estimate of the approximate precipitation may, however, be formed from the following records taken at the Bulawayo Park and at the Observatory. The former station is about a mile distant from the Experimental Grounds.

	Bulawayo Park.	Observatory.
	Inches.	Inches.
Oct. ... ..	.68 (3 days)	.71 (2 days)
Nov.	4.87 (12 days)	4.74 (14 days)
Dec.	5.03 (13 days)	6.31 (15 days)
Jan. ... ..	.88 (2 days)	1.43 (3 days)
Feb. ... ..	.69 (4 days)	.68 (4 days)
Mar. ... ..	.33 (4 days)	.32 (7 days)

Total: 12.48 in 38 days of rain. 14.19 in 45 days of rain.

The first sowings were commenced on the 12th December and the majority were completed by 20th December.

The total rainfall registered at the Park and Observatory and which fell *after* 12th December was 3.62 ins. and 4.31 ins. respectively. Under such circumstances of exceptional drought and on new land indifferently prepared, but little success could be expected. At the same time the relative behaviour of different crops has formed a striking object lesson as to their drought resistance. Though the present report may in one sense be regarded as a record of failures, yet if all the circumstances are taken into consideration it will be seen that the reverse is the case. Indeed, it is hardly too much to claim that already the station has demonstrated what a wide variety of crops can be grown in Matabeleland in a normal season.

All maize plots felt the lack of rain severely, and although some would perhaps have given light yields of grain, it was thought better to reap all for silage. A point of interest is that the Botman variety, a quick maturing and reputed hardy breed, produced no better yield of ears and a considerably lighter crop of fodder than the standard Rhodesian varieties. Kaffir corn also appeared to withstand the drought no better than maize, and gave a lighter yield of green fodder. Among crops of the grass family, Sudan grass was the outstanding success. On all plots where it was sown it gave two light cuttings of hay during the season, and in spite of a thin stand owing to rawness of the land, yielded on an average more than half a ton of hay per acre.

All the legumes, especially velvet beans, cow peas and dolichos beans, grew well, and as may be seen from the yields, were not seriously affected by the drought. This in itself forms a valuable demonstration of the use such crops can be made of in Matabeleland. Even ground nuts made remarkable growth considering the season, and yielded nearly six bags of nuts per acre.

The only succulents grown were A'majortas and sweet potatoes. The former yielded four tons per acre and the latter, although the cuttings were not set out until the 23rd December, established themselves well and gave a yield of nearly two and a half tons of green tops per acre. The tubers, as might be expected, were small, and as they

were left in the ground to produce an early crop again this season, were not weighed.

Sunn hemp was very little troubled by the light rainfall. It yielded seed at the rate of 300 lbs. per acre and clearly proved its suitability as a green manure crop.

Tepary bean of all crops probably afforded the most striking example of drought resistance. Not sown until the 12th January and consequently receiving less than 2 ins. of rain during its growth, it yet managed to return a small yield of grain.

The following crops on the other hand failed entirely: wheat (for hay), manna, oats, teff grass and n'youti. Linseed and Niger oil gave very light yields.

A commencement was made in laying down small plots of some of the best hay and pasture grasses. Amongst those successfully established were: native—Buffel grass, Rhodesian tussock grass, golden Timothy, Guinea grass, molasses grass, swamp couch grass, Napier fodder; exotic—African star grass, Kikuyu, Natal grass and *digitaria eriantha*. Also kudzu vine and beggar weed.

The following tables show the actual yields of all crops reaped:—

GENERAL RESULTS AND PARTICULARS OF CROPS GROWN, SEASON 1921-22.

Name of Crop.	Plot.	Area Sown.	How Sown.	Date of Sowing.	Date of Reaping.	Yield per acre.
Hickory King (+ 7 tons kraal manure per acre)	1a	$\frac{1}{2}$ acre	36 x 18 in.	1921 Dec. 14	1922 Mar. 23	4,648 lbs. green weight
Velvet beans	1b	$\frac{1}{2}$ "	"	" 14	" 23	2,544 lbs. green
Sudan grass	2a	$\frac{1}{2}$ "	Broadcast	" 19	1st cutting Mar. 3	920 lbs. hay
Hickory King	2b	$\frac{1}{2}$ "	36 x 18 in.	" 15	2nd cutting April 20	288 lbs. hay
Spanish ground nuts	3a	$\frac{1}{2}$ "	"	" 16	Mar. 23	5,208 lbs. green
Cow peas	3b	$\frac{1}{2}$ "	"	" 15	April 25	912 lbs.
Velvet beans	3c	$\frac{1}{2}$ "	"	" 15	" 10	3,448 lbs. silage, 40 lbs. grain
Dolichos beans	3d	$\frac{1}{2}$ "	"	" 15	" 10	3,952 lbs. green weight
Kafir corn	4a	$\frac{1}{2}$ "	36 x 9 in.	" 15	" 13	3,744 lbs. "
Maize and velvet beans	4b	$\frac{1}{2}$ "	"	" 16	" 18	4,192 lbs. "
Sundflower	4c	$\frac{1}{2}$ "	"	" 16	Mar. 20	3,448 lbs. "
N'youli	4d	$\frac{1}{2}$ "	Drills, 36 in.	" 16	April 4	6,200 lbs. "
A'majortas	5a	$\frac{1}{2}$ "	8 x 8 ft.	" 17	" 25	Failed
Sweet potatoes	5b	$\frac{1}{2}$ "	18 x 36 in.	" 23	May 8	8,060 lbs. green tops
Kherson oats	6	$\frac{1}{2}$ "	Broadcast	" 20	" 8	Failed
Burt oats	7	$\frac{1}{2}$ "	"	" 20	" 8	Failed
Oats, Sudan and peas	8	$\frac{1}{2}$ "	"	" 21	" 8	800 lbs. hay
Manna	9	$\frac{1}{2}$ "	"	" 22	1st cutting Mar. 3	228 lbs. hay
Pasture grasses, etc.	10	"	"	" 22	2nd cutting April 20	Failed
Salisbury White (+ 200 lbs. complete fertiliser per acre)	11a	$\frac{1}{2}$ acre	18 x 36 in.	Dec. 10	Mar. 23	4,832 lbs. green weight

Name of Crop.	Plot.	Area Sown.	How Sown.	Date of Sowing	Date of Reaping.	Yield per acre.
Velvet beans	11b	$\frac{1}{2}$ acre	18 x 36 in.	1921 Dec. 11	1922 April 28	Ploughed under
Kherson oats	12a	$\frac{1}{2}$ "	Broadcast	" 19	" "	Failed
Salisbury White (unmanured)	12b	$\frac{1}{2}$ "	18 x 36 in.	" 11	Mar. 23	4,808 lbs. green weight
Botman (flint)	13a	$\frac{1}{2}$ "	"	" 12	" 23	4,520 lbs.
Salisbury White (continuous)	13b	$\frac{1}{2}$ "	"	" 12	" 23	5,952 lbs.
Hickory King	14a	$\frac{1}{2}$ "	"	" 12	" 23	5,880 lbs.
Louisiana Hickory	14b	$\frac{1}{2}$ "	"	" 12	" 23	5,488 lbs.
Salisbury White	15a	$\frac{1}{2}$ "	"	" 12	" 23	5,152 lbs.
Potchefstroom Pearl	15b	$\frac{1}{2}$ "	"	" 12	" 23	5,456 lbs.
Yellow Cross wheat	16a	$\frac{1}{2}$ "	Broadcast	" 19	" "	Failed
Tepary beans	16b(1)	$\frac{1}{2}$ "	9 x 36 in.	1922 Jan. 12	Mar. 18	30 lbs. grain
Bird-proof kafir corn	16b(2)	$\frac{1}{2}$ "	"	1921 Dec. 13	" 18	5,100 lbs. green weight
Sudan grass	17	1 "	Broadcast	" 20	1st cutting Mar. 3	1,056 lbs. hay
Teff grass	18a	$\frac{1}{2}$ "	"	" 21	2nd cutting Mar. 20	440 lbs. hay
Niger oil	18b	$\frac{1}{2}$ "	"	" 21	" "	Failed
Velvet beans	19a	$\frac{1}{2}$ "	18 x 36 in.	" 14	Mar. 29	28 lbs. seed
Cow peas	19b	$\frac{1}{2}$ "	"	" 14	" 4	4,368 lbs. green weight
Sunn hemp	20	$\frac{1}{2}$ "	Broadcast	" 21	" 4	3,900 lbs. green weight, 80 lbs. grain
					" "	300 lbs. seed
EXTENSION PLOTS:—						
Linseed	A	$\frac{1}{2}$ "	"	" 22	Mar. 25	80 lbs. seed
Teff grass	B	$\frac{1}{2}$ "	"	" 22	" "	Failed
Yellow Cross wheat	C	$\frac{1}{2}$ "	"	" 22	" "	"

From Breeder to Butcher.

CATTLE FEEDING EXPERIMENT No. 10.

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist.

Means by which the cost of production of our staple crops may be reduced is one of the important problems with which farmers to-day are confronted. No small item in the costs of production is the capital invested in draught animals and, primarily in trek oxen, especially when these essential animals have to be bought. A saving in this direction is one of the many ways in which costs can be lowered.

For several years now it has been a recognised practice on the experiment stations to fatten off each winter a number of the older trek oxen and thus to give them an increased value which in no other way could they command. A humorist recently advanced the theory that by periodically working and resting them, bullocks would be induced to put on flesh and fat alternately, and so would produce "marbled" meat. Needless to say, in the experiment here described this was not the object in view. It is not an unfair inference that had the animals been four or five years younger, and had they been rested for two or three months before the feeding commenced, they could have been finished off more rapidly and more cheaply. The class of meat produced from old trek oxen is at best only "compound," and it is not on this that an export trade can be built up. At the same time the experiment indicates how under present conditions oxen which have for some years been worked in the plough can be fattened off and disposed of at a figure at least equal to their original cost.

Cheapness of feed and the utilisation as far as possible of waste products was constantly kept in view.

The test was conducted with ten old trek bullocks of an average age of thirteen years and which had constantly been worked in the span until the day before the feeding commenced and were at that time in low condition. For the first fifty days these bullocks were grazed in a large grass paddock with free access to a stack of good veld hay, and in addition received morning and evening from troughs in the paddock a small ration of majordas, maize meal, pea and bean

waste consisting of stems, leaves and pods after the grain had been threshed, and sunflower winnowings consisting of chaff and empty hulls after marketable seed had been removed by winnowing. Their *average* ration per head per diem during this period was:—

Majorda.	Maize Meal.	Pea and Bean Waste.	Sunflower Winnowings.
11 lbs.	7 lbs.	1.5 lbs.	2 lbs.

After completing the above period of feeding they were brought up on 2nd July and run loose in open yards for twenty-eight days, and remained in these until they walked nineteen miles into Salisbury and were sold the next day on the open market. During this period of twenty-eight days their *average* daily ration per head was as follows:—

Majorda.	Maize Meal.	Velvet Bean Hay.	Crushed Sunflower.	Veld Hay.
18.5 lbs.	10 lbs.	5.5 lbs.	2 lbs.	10 lbs.

In the earlier part of this period 2.5 lbs. of pea and bean waste were fed with 4 lbs. of velvet bean hay, but when the bean waste was finished the velvet bean hay ration was increased to 7 lbs. per head per diem.

The total of foodstuffs consumed during the seventy-eight days was as follows:—

Veld hay	5 tons approx.
Majordas	5½ „
Velvet bean hay	3 „
Maize meal	34½ bags.
Crushed sunflower	550 lbs.
Pea and bean waste	1,300 „
Sunflower waste	1,800 „

Any practical farmer can work out for himself the value of the above feeds based on his costs of production on the farm, and bearing in mind that he is converting into cash certain unsaleable and other waste products which but for this outlet might be unremunerative.

The average live weight per beast at the beginning of the feeding period was 995 lbs., and at the end 1,108 lbs. The mean increase in live weight per beast during the seventy-six days over which weights were taken was 113.3 lbs., or a daily increase of approximately 1.5 lbs. Younger animals on a similar or better diet would almost certainly have made a better daily increase, but considering their age this may be regarded as a satisfactory one. The highest individual increases were 138 lbs. and 135 lbs. and the lowest 91 lbs. and 90 lbs.

Had these bullocks been put on the market as they left the span and without being fattened, they would most probably have been unsaleable, or at best would have realised an average of £4 to £4 10s. each. If they had been worked through the dry season or even turned

out to grass, some would possibly have died and none would have been capable of working throughout the winter without extra feed. By feeding them on the lines indicated for the period shown, and by turning into meat certain very easily grown crops and certain waste products otherwise unsaleable, they were themselves converted from what may almost be termed unsaleable cattle into "prime compounds." When sold they realised, less commission and stock yard charges, £8 7s. 2d. per head, or rather more than their original cost price. The actual prices realised were:—Three at £10 each, three at £9 each, two at £8 15s. and two at £7 each. Their original cost nine to ten years ago was about £7 10s. per head.

Details of the food given and the live weight increases are shown in the following tables. It will be noticed that during the cold spell between the 12th and the 24th June, when the animals were still running in the grass paddock, and in spite of the maize ration being increased, the gross live weight was practically stationary and several animals even lost weight.

DETAILS OF FOOD CONSUMED.

Week Commencing.	Weight of Pen.	Veld Hay. Per Day.	Majoradas. Per Day.	Velvet Bean Hay. Per Day.	Maize Meal. Per Day.	Pea and Bean Waste. Per Day.	Sunflower Meal. Per Day.	Sunflower Waste. Per Day.
1922 May 15 ...	Pounds. 9,953	<i>ad lib.</i>	Pounds. 70	Pounds. ...	Pounds. 50	Pounds. 10	Pounds. ...	Pounds. 20
May 22 ..	...	<i>ad lib.</i>	110	...	60	10	...	20
May 29 ...	10,358	<i>ad lib.</i>	120	...	60	10	..	20
June 5 ..	...	<i>ad lib.</i>	120	...	60	15	...	30
June 12 ...	10,616	<i>ad lib.</i>	120	...	60	15	...	30
June 17 ..	...	<i>ad lib.</i>	120	...	100	24	...	60
June 24 .	10,600	<i>ad lib.</i>	120	...	100	24	...	60
July 4 ...	...	100 pounds	170	40	100	20	20	...
July 8 ...	10,870	100 pounds	190	40	100	30	20	...
July 22 .	...	100 pounds	190	70	100	...	20	..
July 29 ...	11,086	100 pounds	190	70	100	...	20	...
Total foodstuffs consumed, 5 tons approx. ...		...	11,030	1,490	6,210	1,298	580	1,800

DETAILS OF INCREASE IN LIVE WEIGHT.

Number of beast.	Weight on 15/5/22.	Weight on 29/5/22.	Weight on 12/6/22.	Weight on 24/6/22.	Weight on 8/7/22.	Weight on 29/7/22.
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
1 ...	1,135	1,147	1,200	1,185	1,180	1,230
2 ...	995	1,055	1,042	1,050	1,115	1,125
3 ...	1,090	1,120	1,167	1,155	1,210	1,225
4 ...	859	910	910	880	955	955
5 ...	985	1,055	1,070	1,105	1,115	1,123
6 ...	982	1,022	1,060	1,020	1,015	1,073
7 ...	995	1,030	1,035	1,065	1,085	1,115
8 ...	870	905	945	955	975	980
9 ...	1,170	1,217	1,265	1,265	1,255	1,260
10 ...	872	897	922	920	965	1,000
Total for pen ...	9,953	10,358	10,616	10,600	10,870	11,086
Average per beast ...	995.3	1035.8	1061.6	1060.0	1087.0	1108.6

Winter Cereal Experiments.

SEASON 1921.

By D. E. McLoughlin, Department of Agriculture.

The system under which these co-operative experiments were conducted was the same as in previous years, and the demand for seed was large. These free issues of seed are made for the purpose of trying-out crops and varieties under the farmer's own particular local conditions, thus enabling him to select the best varieties for his farm and to procure reliable seed which is true to the type and variety, while at the same time avoiding the introduction of seed of low vitality or that containing impurities. Incidentally the system supplies the Department with very useful information as to the behaviour of different varieties under different conditions, and such data accumulated from all parts of the country will in time supply a very valuable fund of information.

The only condition attaching to these issues of seed is that a full report on the results shall be furnished to the Department after the crops have been harvested. The report forms are, when possible, despatched at the same time as the seed, thus affording the farmer every opportunity of detailing the treatment accorded to and the progress of the crops.

Very good results with winter cereals are recorded for the season under review, and the yields compare favourably with those obtained in other parts of South Africa where the crops are grown under more favourable conditions and receive greater attention. Certain farmers showed much greater keenness in conducting their experiments than others, and these through paying more attention to their crops obtained more satisfactory results. There is still among a certain section considerable lack of interest shown in the proper carrying out of these valuable trials, and such disheartening reports as "regret crops were damaged by neighbour's cattle" or "crops destroyed by birds" still come to hand. No benefit is derived from such experiments.

In the winter cereal seed distribution of 1921 there were distributed among fifty-three farmers 135 individual parcels of grain, making a total of 2,496 lbs. weight of seed, the varieties being as follows:—

Wheat.—Yellow Cross, 1 issue—20 lbs. Early Gluyas, 42 issues—850 lbs. Union No. 17, 18 issues—360 lbs. Rooi Els Koren, 5 issues—

84 lbs. Lalkasar Wali, 7 issues—79 lbs. American No. 8, 9 issues—135 lbs. Australian Early, 8 issues—64 lbs. Black Persian, 1 issue—4 lbs. No results are recorded for the two varieties Rooi Els Koren and Black Persian, reports on these not having been received.

Early Gluyas Wheat.—*Not irrigated.*—Grown on damp vlei lands; the three highest yields recorded are 800 lbs., 700 lbs. and 540 lbs. respectively of grain from 20 lbs. of seed sown. The average rate of sowing is from 50 to 60 lbs. per acre, so that presumably the above yields are from plots half to a third of an acre in area.

Irrigated.—The highest yields under irrigation are 1,400 lbs. from 50 lbs. of seed sown, 1,350 lbs. from 20 lbs. seed sown, and 600 lbs. from 20 lbs. sown. The splendid yield of 1,350 lbs. was grown on land well manured and sown at the rate of 35 lbs. per acre. Sown the 26th April, and harvested on the 12th October. Eight farmers reported failure owing to climatic conditions or birds. Four reported crops damaged by cattle, and fifteen reports are still outstanding.

Union No. 17.—*Not irrigated.*—The best yield is 1,020 lbs. grain from 20 lbs. of seed sown on approximately one acre of land. Grown in black sandy vlei soil, well manured and typical of that in which most non-irrigated wheat is grown. The land was ploughed and harrowed, the seed broadcasted and then disc harrowed in, the ground being finally rolled.

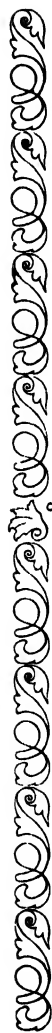
Irrigated.—787 lbs. and 545 lbs. are the highest recorded yields under irrigation from 20 lbs. seed sown. The 787 lbs. yield was grown under the same conditions as the Gluyas Early, which yielded 1,350 lbs. of grain. Two failures were reported owing to drought, and seven reports are still outstanding.

American No. 8.—The best yield was obtained on a damp vlei, the return being 460 lbs. from 15 lbs. sown. The best under irrigation was 365 lbs. from 15 lbs. sown, but this was grown on sandy loam soil, shallow, with a hard pan bottom. One experiment failed. Three reports are still outstanding.

Australian Early.—Of the eight issues of this variety, three were reported to have failed. One report is still outstanding. An excellent yield of 450 lbs. was obtained from 8 lbs. of seed sown on vlei land without irrigation. This was grown on soil similar to that on which Union No. 17 yielded 1,020 lbs. of grain, and received same treatment.

Lalkasar Wali Wheat.—One excellent yield of 1,000 lbs. of grain harvested from 20 lbs. of seed sown was recorded, this crop being grown under irrigation. On damp vlei lands the variety did not apparently show to advantage. One experiment failed owing to rust, and two reports are still outstanding.

Oats.—*Algerian Oats.*—Grown for grain; only one yield of 150 lbs. from 20 lbs. of seed sown is recorded. In most cases the crop was utilised as forage, and in the reports the weights recorded appear to be only approximate. Five farmers report the crop a failure; in two cases it was destroyed by cattle, and five reports are still outstanding.



Black Persian wheat on Mr A R. Morkel's farm Ceres, Shamva



Rye.—As a green feed this crop did exceptionally well, and in one case attained a height of five feet. Birds appear to have caused some damage. Only two cases of failure owing to unfavourable conditions are reported. Two reports are still outstanding.

Smyrna Barley.—This crop was also troubled by birds. Cattle destroyed two experiments, and two failed entirely. Four reports are still to be received. The best yield of grain was 325 lbs. from 20 lbs. sown. In one case the yield of dry forage was at the rate of one ton from 20 lbs. sown. In other instances it provided excellent green fodder.

General.—From a general review of the results, two points emerge. First, the remarkable possibilities of damp vleis soils of Rhodesia, after a normal rainy season, for the growing of cereal crops, especially wheat, in winter. Second, the fact that these possibilities are not yet being taken full advantage of, and that many experimenters when testing the capabilities of their vleis soils are so casual in their preparation of the land, manuring and after-treatment, that the crops are doomed to all but comparative failure before they are sown.

EARLY GLUYAS WHEAT. *Not Irrigated.*

Name of farmer.	Amount sown. lbs	Date of sowing.	Date of reaping.	Amount reaped.	Growers' remarks.
Thos. W. Barnett, Wylde Grove, Umvuma	20	13-5-21	11-10-21	700 lbs	First crop from recently broken up land, of a moist vlel nature.
H. S. Coetzee, Riversdale, Enkeldoorn	20	15-5-21	20-10-21	800 "	Damp vlel land.
Dixon & McLeod, Salisbury	20	25-4-21	October	300 "	Black vlel land.
G. N. Fleming, Salisbury	20	1-6-21	2-11-21	100 "	Damaged by hares and buck.
C. J. M. Hughes, Enay, Gutu	20	25-4-21	20-9-21	540 "	Grown on vlel land ploughed for three seasons.
J. Krienke, Tanga, Beatrice	20	24-4-21	October	240 "	Moist vlel land.
G. J. Palmer, White Gombolia Farm, Macheke	20	19-5-21	2-11-21	35 "	Soil very wet, and birds were troublesome.
E. S. White, Bretten, Concession	20	1-5-21	20-10-21	387 "	Black vlel land. Crop attained height of 5 feet. Several "blind" heads.

Irrigated.

R. le S. Fischer, Coldstream Ranch, Headlands	20	25-4-21	15-9-21	280 lbs	No diseases or pests.
Mrs. L. Fisher, Maonza, Umtali	13	5-5-21	22-9-21	220 "	Birds caused considerable loss.
J. H. Hornby, Ownby, Ruapepe	20	10-4-21	1-10-21	600 "	Consider it very profitable if long distance from rail.
E. Hallam, Lovedale, Umvuma	20	26-4-21	12-10-21	1,350 "	Frost did not do much damage to this variety.
T. W. Taylor, Lancastershire Estate, Gwelo	20	4-6-21	26-10-21	480 "	A portion of the plot was affected by water seepage.
Hacking Bros., Cheapside, Inyanga	50	28-6-21	26-11-21	1,400 "	Suffered a little from want of water and late sowing.
T. Orden-Willows, Brackenbury, Melsetter	20	3rd week May	End of November	Not thrashed	Slightly affected by frost.

UNION No. 17 WHEAT. *Not Irrigated.*

W. A. Britten, Dunrobin, Gwelo	...	20	29-6-21	...	140 lbs	Damp vlei; grew well.
James Harvey, Harvieston, Enkeldoorn	...	20	16-5-21	Latter end of October	1,020 "	Black sandy vlei soil; no noticeable damage by rust, insect pests or frost.
C. A. Kelsey Harvey, Salisbury	...	20	21-5-21	29-10-21	59 "	Land was too wet owing to excessive rains.
E. S. White, Bretten, Concession	...	20	1-5-21	20-10-21	22 "	Failed through drought.

Irrigated.

R. le S. Fischer, Coldstream Ranch, Headlands	...	20	1-5-21	7-10-21	220 lbs	Damp vlei. Free of diseases.
E. Hallam, Lovedale, Umvuma	...	20	26-4-21	12-10-21	787 "	Slightly frosted in one patch. Shattered when dead ripe.
J. M. Monbray, Chipoli, Shamva	...	20	2-5-21	Sept.	230 "	Good all round.
T. W. Taylor, Lancastershire Estate, Gwelo	...	20	3-6-21	24-10-21	545 "	Grown on sandy loam, manured.
H. R. Tillbrook, Norseland, Umtali	...	20	2-5-21	Sept.	40 "	Attacked by birds.

YELLOW CROSS WHEAT. *Not Irrigated.*

H. Fletcher, Cavan Farm, Beatrice	...	20	1st week June	1st week November	105 lbs	Sown on dark sand.
-----------------------------------	-----	----	---------------	-------------------	---------	--------------------

AMERICAN No. 8 WHEAT. *Not Irrigated.*

W. A. Britten, Dunrobin, Gwelo	...	15	27-6-21	...	40 lbs	Did not yield well. Damp vlei land.
H. S. Coetzee, Riversdale, Enkeldoorn	...	15	15-5-21	20-10-21	460 "	Consider seed very dark for the market.
A. F. le Roux, Bathurst, Enkeldoorn	...	15	3-5-21	7-10-21	220 "	

American No. 8 Wheat—continued. *Irrigated.*

Name of farmer.	Amount sown. lbs	Date of sowing.	Date of reaping.	Amount reaped.	Growers' remarks.
R. le S. Fischer, Coldstream Ranch, Headlands	15	7-5-21	10-10-21	200 lbs	No diseases or pests.
T. W. Taylor, Lancastershire Estate, Gwelo	15	4-6-21	14-11-21	365 "	Slightly affected by smut.

AUSTRALIAN EARLY WHEAT. *Not Irrigated.*

W. A. Britten, Dunrobin, Gwelo	8	27-6-21	...	30 lbs	Vlei dried up.
H. S. Coetzee, Riversdale, Enkeldoorn	8	15-5-21	1-10-21	185 "	A good wheat for the market.
James Harvey, Harvieston, Enkeldoorn	8	18-5-21	Latfer end October	450 "	No damage by insect pests or frost.
A. F. le Roux, Bathurst, Enkeldoorn	8	3-5-21	5-10-21	103 "	Moist vlei.

POLISH WHEAT. *Irrigated.*

T. W. Taylor, Lancastershire Estate, Gwelo	40	2-6-21	12-11-21	1,100 lbs	
--	----	--------	----------	-----------	--

LALKASAR WALI WHEAT *Not Irrigated.*

W. A. Britten, Dunrobin, Gwelo	9	27-6-21	...	38 lbs	Damp vlei land, suffered through drought later.
A. F. le Roux, Bathurst, Enkeldoorn	10	7-5-21	...	Failed	Rust.

Irrigated.

R. le S. Fischer, Coldstream Ranch, Headlands	10	1-6-21	28-10-21	500 lbs	Stooled well, fine ears. Free from diseases.
J. M. Moubrey, Chipoli, Shamva	10	4-5-21	Sept.	120 "	
Hacking Bros., Cheapside, Inyanga	10	1-5-21	14-10-21	200 "	Rusted badly.

ALGERIAN OATS. *Not Irrigated.*

Eric D. Barr, Annadale, Chatsworth	20	21-5-21	8-10-21	...	A good crop, cut once green for cattle and later for hay.
Dixon & McLeod, Salisbury	20	10-5-21	October	150 lbs seed	Black vlei, would have proved first-class green fodder.
C. J. M. Hughes, Ency Farm, Gutu	20	25-4-21	20-9-21	...	Did exceedingly well and yielded a very heavy crop, about 3 ft. 6 ins. in height.

Irrigated.

J. H. Hornby, Ownby, Rusape	20	11-4-21	4-10-21	$\frac{1}{2}$ ton forage	I find it one of the most profitable crops to grow for winter.
Major Dobell, Dungarven, Rusape	20	March	Sept.	$\frac{3}{4}$ ton forage	

SMYRNA BARLEY. *Not Irrigated.*

Thos. W. Barnett, Alanberry, Umvuma	20	13-5-21	10-10-21	375 lbs	Did very well. Part of field was cut green for feed. Crop attacked by birds and hares.
G. J. Palmer, White Gombolia Farm, Macheke	20	19-5-21	10-11-21	110 lbs seed	
Eric D. Barr, Annadale, Chatsworth	20	21-5-21	...	600 lbs (estimated)	A very fair crop on new land.

Smyrna Barley—continued. *Irrigated.*

Name of farmer.	Amount sown. lbs	Date of sowing.	Date of reaping.	Amount reaped.	Growers' remarks.
C. H. Cursons, Doctor's Gift, Macheke ...	20	14-5-21	25-10-21	323 lbs	Buck did not worry it, although adjoining wheat. Parts of field got smut.
Mrs. L. Fisher, Maonza, Umtali ...	20	6-5-21	...	1 ton forage	Troubled by birds.
G. C. Watson, Edendale Farm, Hartley ...	20	7-5-21	Sept.	1 ton forage	Cut green and dried, luxuriant growth. Appeared to give a heavier yield of forage than oats.

CAPE EARLY RYE. *Not Irrigated.*

Thos. W. Barnett, Umvuma ...	20	12-5-21	20-10-21	600 lbs (approx.)	Grew a big crop of green feed as well as grain.
Dixon & McLeod, Salisbury ...	20	10-5-21	October	300 lbs	Provided first-class green fodder.
Mrs. A. E. Matthews, The Swallows, Gwelo	20	20-4-21	...	...	Wonderful growth, from 4 to 5 ft. ears 7 in. in length. Cut green for cattle. Impossible to prove better.

Irrigated.

Mrs. L. Fisher, Maonza, Umtali ...	20	6-5-21	...	1 ton forage	Birds caused considerable loss.
H. R. Tillbrook, Umtali ...	20	29-5-21	October	60 lbs seed	Attacked by birds. Grew to 4 ft. in height.

Some Common Diseases of Poultry.

By A. LITTLE, Poultry Expert.

The common diseases of poultry are easily preventable. Those affecting the respiratory organs depend upon exposure of the birds to damp, cold or draughts, or to parasites or to microbes present in these organs. Those affecting the digestive organs depend upon the character and quantity of food, the amount of exercise the birds have had, the grit supplied, whether there has been exposure to cold, damp or draughts, whether the alimentary tract has become obstructed or whether parasites are present.

Those affecting the reproductive system are usually due to the bird being too fat, over-stimulation of the organs or improperly adjusted rations.

Diseases of the brain are usually the result of exposure to too great heat, over-exertion or too high feeding and insufficient exercise.

Poultry keepers should therefore take every care to obviate these conditions; if neglected, constant loss and trouble will be the result.

ROUP.

This disease is highly contagious. Cold, damp weather and draughts aid its development. As in all cases of disease, a bird, one or both of whose parents have suffered from it, is also more susceptible to this disease. There are three varieties:—

- (1) That affecting the eyes.
- (2) That affecting the nasal passages.
- (3) The diphtheritic variety.

The two first can be considered under one heading, viz. :

Contagious Catarrhal Roup.—This form, unless immediate precautions are taken, spreads very rapidly and is one that is very difficult to cope with and to cure. Further, the infection is also very difficult to eradicate from the premises. The germs of the disease can be carried on hands, clothing and boots of the attendants; on the feeding and drinking utensils and the feet of the birds, etc.

Cause.—This is often due to the introduction of the birds from premises where the disease exists; therefore every precaution should be taken to isolate for 30 days and disinfect any new arrivals, no matter

from whence they come. For instance, birds travelling by rail, placed near a coop containing one or more birds suffering from the disease, will almost invariably become affected.

Many are of opinion that an ordinary cold will develop into roup. This idea is absolutely erroneous. The disease is one that cannot possibly develop in the absence of the microbe causing it; but if it is present, the bird suffering from a cold or whose vitality is lowered by some cause or other is much more liable to become affected than the bird that is in good health and condition.

The microbe too is one that survives unless thorough disinfection is carried out on the premises for a very long period, and this accounts for the fact that the disease, apparently cured and absent for some time, suddenly develops again in a flock of birds.

Method of Infection.—The microbe develops and multiplies upon the mucous membranes of the birds; it escapes in the discharge from the nostrils and eyes. This discharge contaminates the feathers, the litter, the food and water utensils, etc., and when dry spreads through the surrounding air in the form of dust, which is drawn into the nostrils or lodges in the eyes. After the germs have so reached these moist and warm surfaces they multiply rapidly owing to favourable conditions; irritation and inflammation are the results, followed by catarrh, ulceration and the formation of purulent and cheesy deposits.

Symptoms.—In the initial stages the symptoms are those of ordinary catarrh, i.e., a thin watery discharge from the nostrils and eyes, accompanied by mopeiness and dulness of the bird. This discharge quickly gives off an offensive odour which is quite unmistakable, and every poultry keeper should be able to detect it immediately. He can then at once adopt measures to check the disease and avoid much trouble, labour and expense. At this stage the bird has some difficulty in breathing, and does so through the mouth instead of through the nostrils. The discharge soon becomes thicker, more glutinous and sticky, and the birds sneeze and shake their heads. They become duller, quieter, they lose appetite, are more or less feverish, the plumage is ruffled, the wings hang down and the comb and wattles become darker in colour. The inflammation continues from the nostrils to the space surrounding the eyes, there being a passage between the two. The secretion becomes abundant and thick, yellowish, purulent and cheesy. It blocks up the passage, forms round the eye and forces the eyeball out of its socket. The nasal passages becoming blocked, pressure is exerted on the palate and breathing and swallowing are obstructed. The final symptoms are:—Very laboured breathing, the beak kept open in order to do so, destruction of the sight, eyes closed and bulging, emaciation, prostration, sleepiness and finally death.

Treatment.—Immediately the disease is noticed, all affected birds should be isolated. Disinfection and spraying of the houses, the ground round them, coops, water and food vessels, etc., should be thoroughly carried out daily. The disinfectant should be mixed with hot water; only the most thorough measures will be of any avail. It is better to kill all birds that have the disease in an advanced form, and the

bodies should be burnt at once. Any that are cured should never be used subsequently for breeding purposes, otherwise the tendency to the disease will be reproduced in the progeny. Treatment of individual birds should also be thoroughly carried out daily, and it is for the owner to decide whether he will undertake the labour and expense of this, with the risk of the infection spreading, or destroy all birds suffering from the disease and so check it at once. Still, individual treatment may be undertaken with fair chances of success, but patience, time and constant attention must be given. The nostrils, mouth and eyes must be washed with antiseptic solutions, and these should be injected into the nostrils and cleft in the roof of the mouth with a syringe. If the disease has not made much headway, one of the following can be used:—

Equal parts of peroxide of hydrogen and water or a 2 per cent. solution of carbolic acid, or 15 grains of boric acid to 1 ounce of water.

If the disease has gone beyond the mild stages, then a 2 per cent. solution of creosote or 1 grain of permanganate of potash to 1 ounce of water, or 5 grains of copper sulphate to 1 ounce of water, is necessary. When the head is inflamed, apply sweet or salad oil or vaseline. In all the drinking water should be placed a few drops of Kerol, Hycol, Isol or similar disinfectant or a little copper sulphate.

If the swellings containing the thick cheesy matter are large, some recommend opening these, washing them out with an antiseptic solution and then dusting in iodoform, but when the disease has reached this stage it is better to kill the bird.

All birds should be made as comfortable as possible and kept free from draughts. Stimulating and easily digested food should be given, to which should be added some meat meal, and plenty of green food also should be given.

It is absolutely of no avail to kill off all the affected birds or treat them individually without daily carrying out the instructions given above as to disinfection of the houses, etc.

Diphtheritic Roup.—This also is a very contagious disease affecting the mucous membranes of the nasal passages, the eyes, the mouth, the pharynx, the larynx, the trachea and the bronchi.

Appearance.—This takes the form of patches of dirty yellow-coloured material on the parts above enumerated, and attached to the mucous surface. They are very similar to those seen in human diphtheria, but the bacillus of avian diphtheria is quite distinct. There are cases on record, though, of diphtheria of fowls being communicated to children, and *vice versa*.

Cause.—It is usually introduced into a flock by exposure to sick birds at shows, or by bringing affected birds on to the premises. The contagion may be carried by birds that have the disease in so mild a form that symptoms are not apparent. The idea that draughts, damp, dirty, badly ventilated houses will cause it is wrong. The bacillus must be present, but the above do certainly increase the

tendency to its development when the bacillus is present. Investigations made by Ducloux indicate that diphtheritic roup is caused by a non-motile bacillus 0.8 to 1.2 micromillimetres broad.

The Method of Infection is similar to that described in contagious catarrhal roup. It affects fowls, turkeys, ducks, guinea-fowl and pigeons. It is often very acute, spreads with very great rapidity and is fatal to most of the birds attacked.

Symptoms.—These commence as in contagious catarrhal roup, with a watery secretion from the nostrils and sometimes from the eyes. The birds seem weak, the plumage is ruffled, breathing is laboured, swallowing is difficult, eyesight affected and the birds are mopy, with head and neck drawn towards the body; they frequently shake their heads and sneeze. On examining the mouth the tongue seems to be pale in colour, and on it will be noticed small greyish spots. The appetite disappears, diarrhoea of a greenish or yellowish colour sets in. The eyes are dilated and walking is irregular and difficult. The patches in the mouth increase in number and size till on the fifth day the whole of the mouth may be covered by them and they may almost completely obstruct the pharynx and larynx. Swallowing and breathing become very difficult. The membranes may extend to air sacs in the lungs and the bird is compelled to extend its neck and open its mouth to admit air. This symptom, by the way, has led many poultry keepers to think the bird is suffering from "gapes," a disease we do not have in this country. The above symptoms are those of the acute form of the disease, which lasts only a few days, when death occurs.

In the chronic form the birds are simply dull, weak, lose flesh and do not lay. There may be slight catarrh and slight difficulty in breathing. Beyond these there are no others, but occasionally a very careful examination will reveal one or two spots in the mouth or throat. This chronic form may continue for weeks, but death is rare.

Prevention.—Birds should not be allowed to mix with others on neighbouring premises. New arrivals or birds returning from shows should be quarantined for thirty days and should occasionally be thoroughly examined. The poultry houses should be kept clean and dry, well ventilated and free from draughts; they should be also open to the sunlight, a point one too seldom sees in this country, where many houses are much too dark and with practically no sunlight penetrating them. Spraying and disinfecting the houses should be carried out occasionally.

Treatment.—Isolate all sick birds; kill the worst cases and burn the bodies. Examine every bird daily and immediately remove any showing the slightest symptoms of illness; spray and disinfect the houses and poultry runs every day, and put in the drinking water of all a little copper sulphate; feed well.

Those that are suffering from the disease should be put into a warm, clean, dry, well-ventilated house. Apply tincture of iodine or paraffin to the patches in the mouth and throat. Boric acid solution as recommended in contagious catarrhal roup should be applied to

the eyes and nostrils daily. Internally the birds should be given a teaspoonful daily of the following: 35 grains chlorate of potash, 2 grains of salicylic acid, 1 ounce of glycerine and 1 ounce of water. Vaccination has been employed successfully by Ducloux.

With regard to the carrying out of the treatment, the same applies as to contagious catarrhal roup, *i.e.*, unless thoroughly carried out daily with patience and perseverance, it is hopeless to look for a cure or elimination of the disease.

Sick fowls that have been cured should on no account be returned to their quarters for thirty days after they have apparently recovered.

Diseases Similar to Diphtheritic Roup are:—

1. Croupous angina, a disease caused by flagellate infusoria; the patches in the mouth and throat in this disease are very like those seen in diphtheritic roup, but are usually confined to the pharynx, oesophagus and crop, and are not seen on the palate, tongue or windpipe.

2. Aspergillosis or brooder pneumonia, caused by a fungus called aspergillus; a disease the external symptoms of which are similar, but in place of the greyish white patches we have white nodules much like those in tuberculosis.

SOUTHERN RHODESIA.

Report of the Veterinary Bacteriologist

FOR THE YEAR 1921.

The routine work of the office, laboratory and inoculation station was curtailed during the absence of the Government Veterinary Bacteriologist on leave, when no vaccines were prepared or issued, and research work was entirely suspended. During his absence the examination of smears and the conduct of official correspondence was entrusted

to the senior lay assistant, and was efficiently and satisfactorily performed. The following table shows the number of preparations received and the principal diseases detected:—

PREPARATIONS RECEIVED FOR DIAGNOSIS DURING 1921.

Month.	Total.	African Coast Fever.	Infectious Abortion.	Quarter Evl.	Anthrax.	Trypano- somis.	Tuber- culosis.	Anaplas- mosis.
January ...	194	25	4	3	1	—	—	8
February ...	220	13	11	13	1	9	—	10
March ...	171	3	10	4	—	1	—	—
April ...	269	1	23	19	1	1	—	4
May ...	260	—	33	11	—	1	4	2
June ...	212	—	39	10	—	3	—	3
July ...	324	—	37	11	—	3	—	—
August ...	253	—	33	9	—	—	—	1
September ...	275	—	45	9	—	2	—	2
October ...	275	—	34	11	—	2	—	—
November ...	169	—	60	9	—	—	—	4
December ...	193	—	17	6	1	1	—	11
	2,815	42	346	115	4	23	1	45

PREPARATIONS RECEIVED FOR DIAGNOSIS DURING 1920.

	1,827	167	75	133	4	5	4	—
--	-------	-----	----	-----	---	---	---	---

The number of preparations received was nearly 1,000 more than in the previous year, but this was largely due to the increased number of specimens of blood collected by the pipette method and forwarded for the detection of infectious abortion by the agglutination test. This simple method of obtaining and preserving blood has proved most satisfactory, and it is now rare to receive a preparation unsuitable for the test. In view of the fact that certain authorities consider the best method of dealing with the disease to be early detection and segregation of infected animals, the simplification of this somewhat delicate test is of great advantage.

INFECTIOUS ABORTION.—The following table shows the number of herds found to be infected in the different districts, and indicates the very general distribution of the disease:—

INFECTIOUS ABORTION.

List of Infected Areas.

District.	Sub-District.	No. of Herds Infected.	Total.
Umtali—		3	
	Macheke	4	
	Rusape	3	
	Headlands	1	11
Melsetter		2	2
Salisbury—		10	
	Bromley	3	
	Mrewa	1	
	Marandellas	12	
	Lomagundi	11	
	Beatrice	6	
	Norton	2	
	Hartley	5	
	Mazoe	3	
	Shamva	1	
	Bindura	4	
	Arcturus	2	60
Victoria—		2	
	Chilimanzi	1	
	Chibi	1	4
Gwelo—		10	
	Que Que	10	
	Umvuma	6	
	Selukwe	3	
	Felixburg	2	
	Enkeldoorn	4	35
Bulawayo—		2	
	Shangani	2	4
Gwanda		1	1
		117	117

It is generally believed that the principal source of infection is by the ingestion of infective material, and that infection by the bull is of less importance than was at one time supposed. In this country, however, outbreaks have occurred which apparently originated with the introduction of a new bull to the herd. The following figures are therefore of interest:—

Infection of Bulls.

Total number of infected herds	117
Total number of bulls tested	202
Total number of bulls yielding positive re-actions	19 (or 9.4%)

The treatment of cattle in infected herds by the special vaccine prepared at this laboratory has found favour not only with the great majority of owners of treated cattle, but also with the members of the

veterinary profession, who at a recent meeting of the Southern Rhodesia Veterinary Association re-affirmed the high opinion of it expressed at the Veterinary Conference held in August, 1920, and decided that the good results obtained justified its continued use. Measures of quarantine and control were formulated based upon its application. The approval of practical members of the profession largely discounts the reviews of those who have unfavourably criticised the vaccine on the assumption that it is the same as the so-called "dead" vaccine in which the organisms and their properties have been destroyed by heat. As explained in previous reports, the Rhodesian vaccine is not submitted to heat, but to a special process which renders the bacillus inert without destroying those properties which are necessary for the production of anti-bodies. Thus the response to this vaccine, as indicated by the agglutination titre of the blood, compares favourably with that produced by a similar quantity of living organisms, and the vaccine appears to be a valuable substitute for the so-called "live" vaccine, which under the conditions obtaining in this country cannot be applied without grave danger. In some cases where results have been disappointing, careful enquiry has shown that instructions were not carried out, or that many of the animals at the time of treatment were already well advanced in pregnancy and probably infected, so that the expulsion of the calf was inevitable. In some cases also the dose was too small to render the animals immune throughout the nine months of pregnancy; but this was soon realised and promptly rectified, free issues of vaccine being supplied to the owners of herds in which abortions had continued to occur. Attention has been forcibly drawn to the danger of relying upon the disease to "wear itself out." What generally happens in this country is that the disease assumes a chronic form in a herd, and although abortions are rarely detected, the low calf crop and the large number of sterile cows indicates its presence. Like a smouldering fire, the outbreak bursts into flame again with the addition of new fuel in the form of uninfected and susceptible female stock introduced to the herd. Such outbreaks have frequently escaped detection by the agglutination test until an abortion has occurred in a newly introduced cow which has re-acted to the test. It is pleasing to record that the best results have attended the use of the vaccine in such outbreaks, and in one very valuable herd of Shorthorns in which a healthy calf has not been born for several years, a number of cows which were condemned as barren, after treatment, became pregnant. Some have given birth to healthy calves, and the rest appear to be holding their calves to full term. It is probable that in this country such barren or "queen" cows, acting as "carriers," are a frequent source of danger, and if the vaccine treatment succeeds in eliminating these cases it is of inestimable value. It is felt that the methods adopted by the Veterinary Department of this Territory in dealing with infectious abortion compare more than favourably with those obtaining elsewhere. However imperfect they may be, an earnest endeavour has been made to cope with a disease which other Administrations have admitted their inability to control, and have removed from the list of scheduled diseases, a course which would not commend itself to the stock-owning community of Rhodesia. It has recently been suggested that the infectious abortion of cattle as it occurs in

this country is related to a disease of human subjects closely resembling undulant or Malta fever. The *Bacillus abortus* of Bang certainly bears a close morphological and biological resemblance to the *Micrococcus melitensis*; serological tests also indicate a close affinity, in that certain strains of *M. melitensis* can be agglutinated with serum from cattle infected with infectious abortion, and strains of *B. abortus* can be agglutinated by serum from human patients suffering from undulant fever. Certain cases presenting symptoms resembling undulant fever have occurred in Southern Rhodesia in men who, as far as is known, cannot have obtained infection from goats, but have resided on farms where animals are or have been infected with infectious abortion. It is suggested that these cases are suffering from an infection caused by the *B. abortus* of cattle. It is also suggested that human females may contract infectious abortion through the ingestion of the organism in milk and dairy products from infected cows. Although infectious abortion of cattle is prevalent in other parts of the world, it has not been accused of causing the symptoms of undulant fever in man, nor has it been proved to cause abortion in human subjects. Infectious abortion has prevailed in the Marandellas district for many years, but it is only within the last few months that cases resembling undulant fever in man have been recorded. While circumstantial evidence points to the infection of man by the *B. abortus* of Bang, and scientific tests up to a point support this suspicion, the final proof is not yet available. This is a serious matter requiring immediate and careful investigation.

HORSE-SICKNESS.—The inoculation of horses by the Rhodesian method has been continued with considerable success. Seventy-seven remounts for the British South Africa Police were treated at the Drill Hall stables, and were useful for experiment and observation, but the greater risks associated with research could not be taken with such costly animals. A number of privately-owned horses of varying ages was also inoculated by the Bacteriologist, and the results obtained proved of considerable interest and importance. Of the 110 horses thus treated, six died, or 5.45 per cent., as against 7.26 per cent. for the year 1920 and 13.8 per cent. for the year 1919. At the commencement of the year there were 297 inoculated horses on the strength of the British South Africa Police, and at the end of the year 308, 77 remounts having been added during the year and 66 having been struck off the strength. Approximately 300 horses have thus been exposed to infection during the year, and of these 17 are stated to have died of horse-sickness, or 5.6 per cent. The actual percentage of deaths from horse-sickness may be less, as it is probable that several of the animals reported to have died from horse-sickness died from some other cause. This compares favourably with the death rate among privately-owned horses inoculated last year, which from the few figures available appears to be about 9.3 per cent. It may be remarked, however, that one hears more about the failures than the successes, and the real average is undoubtedly very much less. Owners are often extremely poor horse-masters and diagnosticians, and the term "horse-sickness" is used to cover a multitude of ills. The figure is increased also by the inclusion of deaths in part of the Victoria district, where for some reason horses

inoculated by the District Veterinary Surgeon have not proved immune, the death rate being as high as 28.5 per cent. This is difficult to explain in view of the fact that of 25 Police horses inoculated by the Bacteriologist and exposed throughout the district to every risk, two only are reported to have died of horse-sickness; and on the Nuanetsi Ranch three horses inoculated by him have survived, while five others inoculated locally have died. Inoculated horses when exposed to natural infection become re-infected with the virus of the district to which they are sent; thus among inoculated Police horses 60 are known to have developed horse-sickness during the past season, but 50 of them recovered after a few days' illness. In Police Orders it is laid down that when horses show a temperature or symptoms that they are suffering from horse-sickness they shall be kept undisturbed in a quiet cool place, without special medicinal treatment, until again normal. Although similar instructions are issued to the public, they are not so carefully observed. In the past the inoculation of horses for the public has only been applied by District Veterinary Surgeons to animals not exceeding two-and-a-half years of age, on the ground that young horses often possess some degree of immunity which favourably modifies the re-action. But it has now been found that this is not entirely an advantage, in that a number of cases do not re-act at all, and thus derive no immunity. The difficulty in handling and tempering young unbroken animals renders it impossible to decide whether they have re-acted or not, and many which derive no benefit from the treatment succumb later from natural infection. The risk of inoculating older horses is greater, but the after results are better, as the majority of them re-act at the time of inoculation. The condition, age and individual susceptibility of the animal also play an important part, and for that reason it is thought best that the inoculation of older animals shall remain a laboratory process. It must again be pointed out that this method of inoculation is by no means perfect, being to a large extent empirical, and must remain so until further observation and research has been carried out. All that can be said of the existing method is that it has cost nothing, it has revolutionised the Police as a mounted force, and it has rendered horse-breeding in Rhodesia a practical and profitable proposition. From the personal point of view, however, it would be better to suspend any further issue of vaccine until the method has been placed upon a more scientific basis.

BOVINE PLASMOSES.—It is to be regretted that no valuable imported stock have been forwarded for inoculation against redwater and gall-sickness during the present year. This is chiefly due to the difficulty of obtaining freight from Great Britain and the excessive shipping and railage charges. The more general application of systematic dipping has also rendered it possible to introduce highly bred cattle to "clean" farms with so little risk that owners have come to regard inoculation as unnecessary. Some of the more venturesome have lived to regret their decision. Another reason why it has been unnecessary to send cattle to the inoculation station at Salisbury is that the virus now used for immunising is of such low virulence that it can be applied to suitable animals on the owner's premises. With the increased appli-

cation of dipping, the necessity for rendering young stock immune against redwater and gall-sickness becomes greater, and already breeders of better class stock on regularly dipped farms are finding that the market for their susceptible cattle is restricted. The more progressive stockmen, including many pre-eminent in the show ring, are inoculating their calves by the method devised at this laboratory with considerable success. In spite of lectures and pamphlets, the benefits to be derived from this process do not appear to be generally understood. Recent reports show that animals so inoculated and exported to Portuguese East Africa have lived where hitherto the majority of imported stock have died, and it is hoped that when stock markets have returned to normal conditions advantage will be taken of this fact.

TRYPANOSOMIASIS.—A few cases of trypanosomiasis have been recorded, and where the drug treatment has been applied it has proved successful. Some authorities continue to attribute these outbreaks to mechanical transmission by blood-sucking flies other than the tsetse. If this were a common method of infection, the dispersal of reservoirs by shooting expeditions would appear to be unjustifiable; but although cases of mechanical transmission may occasionally occur, the conditions necessary for such infection do not commonly obtain in this country. Briefly, these are the introduction of the disease by an infected animal containing a large number of trypanosomes in its peripheral blood to a district where suitable conditions of heat and moisture prevail, close contact among animals, and a large number of biting insects. A combination of such conditions is rarely met with in Southern Rhodesia, and practical experience shows that if mechanical transmission takes place it is the exception rather than the rule.

VACCINES.—The following vaccines were issued during the year, but the issue was suspended during the absence of the Government Veterinary Bacteriologist for four-and-a-half months, so that the figures relate to only seven-and-a-half months' output:—

Infectious Abortion Vaccine.

1,150 doses issued free of charge	£57 10 0
26,878 doses issued at 1s. per dose	1,343 18 0

Horse-Sickness Vaccine.

410 doses 1st inoculation for horses at £1 per dose .	410 0 0
99 doses 2nd inoculation for horses at 5s. per dose ...	24 15 0
93 doses for mules	93 0 0
11 doses (free issue)	11 0 0
77 doses (free issue to B.S.A. Police)	77 0 0

Redwater and Gall-Sickness Vaccine.

600 doses at 1s. per dose	30 0 0
-----------------------------------	--------

Value	£2,047 3 0
Less free issue	145 10 0

Cash received	£1,901 13 0
-----------------------	-------------

It is anticipated that when the new veterinary research station now in course of construction is completed, equipped and organised, the output will be considerably increased, but the question arises whether vaccine should be sold at a profit or at cost price to the public, inasmuch as the primary object of the institution is to safeguard and assist the pastoral industry. It must be borne in mind, however, that to produce larger quantities of vaccine will involve increased expenditure on staff and equipment.

STAFF.—During the year the staff has comprised the following officers:—

L. E. W. Bevan, Government Veterinary Bacteriologist.

A. J. Crisp, Senior Technical Assistant.

Miss M. Perrins, Junior Technical Assistant and Senior Clerical Assistant.

Miss O. R. Newton, Junior Clerical Assistant.

H. E. Browne, Stockman.

Review.

AN ELEMENTARY BIOLOGY FOR SOUTH AFRICAN SCHOOLS.

We have seen many nature-study books designed for use in schools, but we have seldom had the pleasure of reading one so concise, clear and comprehensive as that under review. The author is S. H. Skaife, M.A., M.Sc., F.E.S., who has also written a work called "Animal Life in South Africa." The present volume is not only written in language of great simplicity and quite remarkable lucidity, but the plan of the book is so good that the ideas expounded proceed by progressive steps from the simplest onwards, and the plan is executed with such skill that each new item of information presented seems to be just the natural and obvious sequence of that preceding it. As a result, the reader's interest is maintained continuously, and he goes on imbibing knowledge almost unconsciously.

The first chapter treats of the properties of the soil as the essential fount of all vegetable life. The next twelve chapters are concerned with plants as the basis of all animal life. The functions of every

plant organ are explained and illustrated in a way which, while missing none of the fundamental facts, is not over-loaded with detail. Seeds, roots, stems, leaves, flowers and fruits are discussed in their turn, the exact service of each in the life history of the plant explained, and particulars given of quite simple and inexpensive experiments, by means of which most of the important statements made can be tested and proved. Following this study of plant physiology, a brief but easily understood account is given of the kingdom of plants from the simplest single-cell forms to the highly organised forest tree. The principles underlying classification are unfolded in a masterly manner within the compass of six short chapters, and no one can read this part of the book without obtaining a good perspective view of the world of plants.

Two-thirds of the book are devoted to the animal kingdom, and insects and their closer allies occupy one-half of the total. In this section the insects of agricultural and horticultural importance receive preponderant attention, several, such as the apple codling moth, the Australian bug, mosquitoes, the maize stalk borer, the bean weevil, etc., being dealt with in considerable detail. Whilst this renders the account somewhat ill-balanced, the codling moth, for instance, occupying some seventeen pages, whilst the whole division of mammalia is dismissed in five, this is quite in accordance with the apparent object of the writer. It is obvious that in a comparatively small book the vast science of biology can only be dealt with in an exceedingly superficial manner, and if such a publication is to have any value at all it must lie rather in directing the attention of the young student to natural objects than in furnishing any mass of information. The detailed accounts given in a few cases indicate the manner in which research in zoology may be put to practical use, and this cannot fail to be of educational value to South African youths, particularly in the rural districts. The suggestions for "practical work" at the end of each chapter appear to be well calculated to arouse and maintain an interest in natural history, and may prove to be the means of leading some of our future scientists in the direction of their life's work, as well as of broadening the general outlook on life of the coming generation. In view of the fact that nature study has been so much neglected in primary and even secondary schools in the past that amongst adults of the present generation the most elementary facts of biological science commonly constitute a completely closed volume, the appearance of the present aid to a wider knowledge of nature and a wider outlook generally is particularly welcome, and Mr. Skaife is to be heartily congratulated on the result of his labours.

The publisher of this "Elementary Biology" is Mr. T. Maskew Miller, of Capetown, and the price is 6s. We have no hesitation in recommending this book for use in Rhodesian schools. It lays much stress on the agricultural aspect of the subject, and might with advantage be studied by farmers who have left school. The illustrations are well executed wood engravings from drawings by the author. They are bold, clear and adequate for the purpose desired.

F. E. and R. W. J.

Rates for Pigs Consigned to the Union.

With effect from the 1st September, pigs (loose) in truck loads consigned to a market or bacon factory in the Union from points beyond Bulawayo will be charged over the Rhodesia Railways to Mafeking at the special rates in operation for slaughter cattle sent to the south.

The schedules printed herewith show the old and the new rates, from which it will be seen that the new method of charging involves a substantial reduction in the previous rates.

*Statement showing present and revised rates, excluding cleansing fees, on pigs per short truck, containing 35 head, to
Estcourt from:—*

	Present Charges per Short Truck.			Present Charges per Head.		Revised Charges per Short Truck.			Revised Charges per Head.	
	£	s.	d.	s.	d.	£	s.	d.	s.	d.
Balla Balla	18	0	1	10	3	17	14	7	10	2
Nyamandhlovu	17	4	1	9	10					
Gwanda	19	12	1	11	2	17	18	9	10	3
Shangani	18	8	1	10	6					
Globe & Phoenix	22	0	1	12	7	18	2	11	10	4
Gwelo	20	8	1	11	8					
Lalapansi	21	4	1	12	1	18	7	1	10	6
Battlefields	22	16	1	13	0					
Umvuma	22	8	1	12	10	18	11	3	10	7
Fort Victoria	25	4	1	14	5					
Gadzema	24	16	1	14	2	18	15	5	10	9
Salisbury	26	12	1	15	2					
Glendale	27	12	1	15	9	19	10	0	11	2
Marandellas										
Shamva	23	8	1	16	3	20	4	7	11	7
Sinoia										
Odzi	29	12	1	16	11	20	19	2	12	0
Umtali	30	0	1	17	2	21	13	9	12	5

Statement showing present and revised rates, excluding cleansing charges, on pigs per short truck, containing 35 head, to Johannesburg from:—

	Present Charges per Short Truck.			Present Charges per Head.		Revised Charges per Short Truck.			Revised Charges per Head.	
	£	s.	d.	s.	d.	£	s.	d.	s.	d.
Balla Balla	14	3	0	8	1					
Nyamandhlovu	13	7	0	7	8	13	17	6	7	11
Gwanda	15	15	0	9	0					
Shangani	14	11	0	8	4	14	1	8	8	1
Globe & Phoenix ...	18	3	0	10	4					
Gwelo	16	11	0	9	5	14	5	10	8	2
Lalapansi	17	7	0	9	11					
Battlefields	18	19	0	10	10					
Umvuma	18	11	0	10	7	14	10	0	8	3
Fort Victoria ...	21	7	0	12	2					
Gadzema	20	19	0	12	0	14	14	2	8	5
Salisbury	22	15	0	13	0	14	18	4	8	6
Glendale										
Marandellas	23	15	0	13	7	15	12	11	8	11
Shamva										
Sinoia	24	11	0	14	0	16	7	6	9	4
Odzi	25	15	0	14	9	17	2	1	9	9
Umtali	26	3	0	14	11	17	16	8	10	2

The Salisbury Show.

RESULTS OF THE MILKING COMPETITION.

The following table shows the points awarded to the cows entered for the two days' milking competition at the Salisbury Show. The competition was held on Sunday and Monday, the two days preceding the Show. The following scale of points fixed by the rules of the British Dairy Farmers' Association was adopted in this competition.

Lactation.—One point for every ten days since calving, deducting

the first 40 days, with a maximum of 14 points.

Quantity of Milk.—One point for every pound of milk.

Quality of Milk.—Twenty points for every pound of butter fat, and four points for every pound of solids not fat, deducting ten points each time the fat falls below three per cent., and ten points each time solids not fat fall below eight per cent.:—

Time of Milking.	Total Lactation Days.	Lbs. Milk.	Specific Gravity.	Percentage of Butter Fat.	Percentage of Solids not Fat.	Lbs. of Butter Fat.	Lbs. of Solids not Fat.	Points for Lactation.	Points for Quantity.	Points for Butter Fat.	Points for Solids not Fat.	Deductions—Fat.	Deductions—Solids not Fat.	Corrected Points.	Grand Total Points.	Name of Owner.	Name of Cow.	Breed.
1st—																		
7 a.m.	7	23.0	1.033	3.0	9.0	.690	2.07	14	23.0	13.30	8.28	—	—	45.08	145.08	J. S. Struthers	(Daisy),	Fries.
5 p.m.		15.3	1.031	3.4	8.6	.520	1.32		15.3	10.40	5.38	—	—	31.08				
7 a.m.		20.2	1.030	3.2	8.3	.650	1.68		20.2	13.00	6.72	—	—	38.92				
5 p.m.		13.8	1.031	3.8	8.7	.520	1.20		13.8	10.40	4.80	—	—	28.00				
2nd—																		
7 a.m.	182	16.25	1.030	5.0	8.7	.815	1.414	14	16.3	16.30	5.65	—	—	52.25	138.97	J. A. Baxter	(Ruby),	Shorthorn
5 p.m.		11.50	1.028	5.2	8.2	.598	.943		11.5	11.96	3.76	—	—	27.22				
7 a.m.		15.20	1.030	4.7	8.6	.714	1.307		15.2	14.28	5.23	—	—	34.71				
5 p.m.		10.80	1.029	4.8	8.4	.518	.907		10.8	10.36	3.63	—	—	24.79				
3rd—																		
7 a.m.	45	19.0	1.029	3.5	8.1	.665	1.54	0.5	19.0	13.30	5.16	—	—	38.96	138.08	Knight & Folkstad	(Rosalind),	Shorthorn
5 p.m.		15.3	1.030	5.2	8.7	.785	1.33		15.3	15.90	5.32	—	—	36.52				
7 a.m.		17.5	1.030	3.4	8.5	.595	1.49		17.5	11.90	5.96	—	—	35.36				
5 p.m.		13.6	1.029	3.4	8.1	.462	1.10		13.6	9.24	4.40	—	—	27.24				

4th—																
7 a.m.	248	17.75	1.031	3.6	8.6	.639	1.526	14	17.75	12.76	6.10	—	50.61	128.25	J. A. Baxter (Daisy Bell), Fries.	
5 p.m.		12.50	1.028	3.8	7.9	.475	.988		12.50	9.52	3.95	—	10 15.95			
7 a.m.		18.00	1.030	3.2	8.3	.576	1.494		18.00	11.50	5.98	—	—	37.19		
5 p.m.		13.3	1.029	3.6	8.1	.479	1.077		13.30	9.58	4.31	—	—	—		
5th—																
7 a.m.	114	18.0	1.031	3.6	8.65	.648	1.557	7.4	18.0	12.96	6.23	—	44.59	127.59	W. R. Waller (Spotta), R. Poll	
5 p.m.		12.0	1.030	3.6	8.40	.432	1.008		12.0	8.64	4.03	—	24.67			
7 a.m.		16.8	1.030	3.1	8.30	.521	1.394		16.8	10.42	5.57	—	32.79			
5 p.m.		12.5	1.031	3.5	8.60	.437	1.075		12.5	8.74	4.30	—	25.54			
6th—																
7 a.m.	117	15.5	1.032	3.3	8.8	.512	1.364	7.7	15.5	10.24	5.46	—	38.90	118.78	W. R. Waller (Bronze), R. Poll	
5 p.m.		12.0	1.031	4.0	8.7	.480	1.040		12.0	9.60	4.16	—	25.76			
7 a.m.		16.5	1.032	3.3	8.8	.512	1.364		15.5	10.24	5.46	—	31.20			
5 p.m.		11.1	1.031	3.6	8.6	.400	.9546		11.1	8.00	3.82	—	22.92			
7th—																
7 a.m.	25	16.5	1.031	3.0	8.5	.495	1.402		16.5	9.90	5.61	—	32.01	105.77	Knight & Folkstad (Daisy), Fries.	
5 p.m.		12.5	1.031	3.9	8.7	.488	1.088		12.5	9.67	4.35	—	26.52			
7 a.m.		16.0	1.031	2.8	8.5	.448	1.360		16.0	8.96	5.44	10	20.40			
5 p.m.		12.5	1.031	4.0	8.7	.500	1.086		12.5	10.00	4.34	—	26.84			
8th—																
7 a.m.	352	16.5	1.026	3.1	7.3	.512	1.20	14	16.5	10.24	4.80	—	10 35.54	86.98	J. S. Struthers (Cherry), Fries.	
5 p.m.		12.0	1.027	4.0	7.7	.480	.92		12.0	9.60	3.68	—	10 15.28			
7 a.m.		16.6	1.027	3.0	7.5	.498	1.24		16.6	9.96	4.96	—	10 21.52			
5 p.m.		12.4	1.026	3.5	7.2	.434	.89		12.4	8.68	3.56	—	10 14.64			
9th—																
7 a.m.	66	12.0	1.031	2.5	8.4	.300	1.008	2.6	12.0	6.00	4.03	10	13.03	71.70	J. Dennis & Co. (Nellie), Shtn.	
5 p.m.		9.5	1.028	5.1	8.3	.484	.788		9.5	9.68	3.15	—	22.33			
7 a.m.		14.0	1.028	3.4	7.9	.476	1.106	-	14.0	9.52	4.42	—	10 17.94			
5 p.m.		9.0	1.029	3.6	8.1	.324	.729		9.0	6.48	2.92	—	18.40			
10th—																
7 a.m.	25	9.5	1.030	3.2	8.3	.304	.7885		9.50	6.08	3.15	—	18.73	64.59	J. Dennis & Co. (Badala), Fries.	
5 p.m.		8.75	1.030	4.2	8.5	.368	.7440		8.75	7.36	2.97	—	19.08			
7 a.m.		9.5	1.031	1.8	8.3	.171	.7885		9.50	3.42	3.15	10	6.07			
5 p.m.		9.5	1.030	4.2	8.5	.399	.8075		9.50	7.98	3.23	—	20.71			

RHODESIAN MILK RECORDS.

Name of cow.	Breed.	Commenced record.	Milk in lbs. Latest return.	Butter fat in lbs. Latest return.	Milk in lbs. to date.	Butter fat in lbs. to date.	Number of returns to date.	Name and address of owner.
Brakfontein Aggie ...	Friesland	1/2/22	727.5	...	4,599.25	...	5	Renniker & Rettie, Salisbury
Gippy ...	do	22/8/21	759.5	...	4,712.25	...	6	J. H. Parker, Vailima Dairy, Eyo.
Ann ...	Shorthorn	15/2/22	305.9	14.07	2,128.7	95.48	6	C. G. T. Cooper, Essexvale.
Rosebud ...	Friesland	9/10/21	182	10.92	4,728	227.42	9	J. S. Struthers, Palm Tree, Sinoia
Granay ...	do	do	259	9.88	4,382	187.18	9	do
Maureen ...	do	do	100.1	35.03	6,232	236.42	8	do
Cherry Blossom ...	do	16/10/21	227	11.8	5,251	263.61	10	do
Bell ...	do	20/11/21	105	4.2	8,324	311.48	9	do
Snowflake ...	do	22/1/22	319	12.76	3,872	142.49	7	do
Lady ...	do	4/2/22	287	13.77	3,527	150.64	6	do
Corral ...	do	19/2/22	541	29.75	4,706	237.89	5	do
Pansy IV. ...	do	6/5/22	817	...	2,649	...	3	C. F. Anthony, Randolph Farm, Gwelo
Quettie ...	do	8/10/21	472.5	...	6,095.5	...	7	G. W. Davis, N'Gombe, Sinoia
Rose ...	Red Poll	25/11/21	472.5	17.93	4,732	180.95	8	W. R. Waller, Bluff Hill, Salisbury
Alice ...	do	do	763	28.23	6,495	256.89	8	do

Southern Rhodesia Veterinary Report.

June, 1922.

AFRICAN COAST FEVER.

MELSETTER DISTRICT.—During the process of removing the infected herds on Merino and adjoining farms to clean veld through temperature camps three animals were destroyed on suspicion. At the Randfontein infected centre two animals died from Coast Fever.

CHARTER DISTRICT.—A fresh outbreak occurred on the farm Chiŋpisa, where an ox died on 3rd June. No other cases had occurred to end of month. At the previously infected centres the mortality was as follows:—Wiltshire Estate 388, Swartfontein 50, Mobifontein 2.

QUARTER-EVIL.

The following mortality in cattle was reported:—Marandellas 3, Umtali 20 (also one case in a sheep), Melsetter 4, Hartley 3, Gwelo 23, Victoria 12, Insiza 10, Inyati 35, Bulawayo 10, Plumtree 32, Umzingwane 25, Matobo 12, Belingwe 14, Gwanda 4.

CONTAGIOUS ABORTION OF CATTLE.

Centres of infection previously unknown were reported from the Mazoe, Lomagundi, Umtali, Selukwe, Chilimanzi and Chibi districts.

HORSE-SICKNESS.

No deaths reported.

TRYPANOSOMIASIS.

Seven suspected cases in cattle reported from the Lomagundi and Darwin districts. In the Melsetter district two deaths (cattle) occurred.

SWEATING SICKNESS OF CALVES.

One case in the Lomagundi district.

WIRE WORM IN CATTLE.

A few cases of gross infestation have been observed, and there is no doubt that the mortality from poverty during the winter months is largely due to the presence of these parasites. Stock owners are advised that early treatment is necessary if satisfactory results are to be obtained.

IMPORTATIONS.

From the Union of South Africa:—Bulls 12, heifers 14, horses 92, mules 38, donkeys 34, sheep 1,895, goats 711.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 1,705, breeding cattle *via* Liebig's Drift 359, pigs 86. To Northern Rhodesia:—Horse 1, pigs 4, sheep 125. To Congo:—Pigs 45. To Portuguese East Africa:—Horse 1, mules 2, donkeys 12.

July, 1922.

AFRICAN COAST FEVER.

MELSETTER DISTRICT.—A fresh outbreak occurred on the farm Umzelezwe, adjoining the infected farm Bamboo Creek. Two animals died and two remaining were destroyed. No cases at any of the previously infected centres.

CHARTER DISTRICT.—No fresh outbreaks. The following mortality occurred at previously infected centres:—Wiltshire Estate 180, Swartfontein 24, Chipisa 26, Mooifontein 1.

MAZOE DISTRICT.—All restrictions were withdrawn, no case of disease having occurred for over sixteen months.

QUARTER-EVIL.

The following mortality in cattle was reported:—Marandellas 3, Lomagundi 40, Mazoe 20, Makoni 8, Melsetter 6, Hartley 2, Victoria 15, Gwelo 7, Selukwe 3, Shabani 4, Bulawayo 1, Plumtree 30, Umzingwane 10, Matobo 18, Nyamandhlovu 5, Insiza 18, Belingwe 3, Antelope 31, Gwanda 13.

CONTAGIOUS ABORTION OF CATTLE.

Centres of infection previously unknown were reported from the Mrewa, Lomagundi, Mazoe, Makoni, Melsetter, Gwelo, Umzingwane and Plumtree districts.

TUBERCULOSIS.

The existence of tuberculosis amongst the cattle on the farm Mimosa Park, Nyamandhlovu district, was discovered through the death of a bull undergoing quarantine prior to export to Northern Rhodesia. *Post mortem* examination of this animal showed typical lesions of this disease, and microscopical examinations were confirmatory. The source of infection appears to have been in a consignment of bulls and heifers imported from the Orange Free State in October, 1921. All in-contacts, 53 head, were tested with tuberculin. Four re-acted, and *post mortem* examinations revealed the existence of the

disease in each case. At the Shangani Estates 54 head of young stock were tested with tuberculin; one animal re-acted.

IMPORTATIONS.

From the Union of South Africa:—Bulls 13, heifers 8, horses 50, mules 84, donkeys 10, sheep 2,439, goats 573.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 2,427, pigs 3. To Northern Rhodesia:—Bulls 44, heifers 17, sheep 190. To Congo:—Bulls 14, heifers 16, horses 4, mules 8. To Portuguese East Africa:—Cows 84, oxen 72, horses 4, donkeys 18.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

Agricultural Outlook.

Farmers are anxiously looking for the arrival of the rains, which it is to be hoped will not be long delayed. Some rain is reported to have fallen in parts of the Plumtree and Marandellas districts, but although the portents have been favourable, the rest of the country is still awaiting a break in the weather. The veld is of course parched, and what grass remains has little feeding value. Cattle are naturally falling off in condition, and unless good drenching rains set in soon, it is feared losses of stock will occur. So far cattle have weathered the trying conditions extremely well, and the past season will stand as a monument to the wonderful quality of the Rhodesian veld. But there is a limit to all things, and that limit has nearly been reached in some parts of the country. There has been surprisingly little transfer of cattle to fresh pasturage, but we would urge those farmers whose supplies of grazing and water are giving out to avail themselves without delay of the facilities offered by the railway administration. Fortunately grass fires have been less in evidence this season, due undoubtedly to the active co-operation of the Police and the Native Department with the farming community. Some farmers apparently are slow to seek this assistance, for a Native Commissioner writes:

"No land owner has attempted to seek the co-operation of this Department in burning fireguards, although they are well aware that assistance would be given."

The slump in prices of cattle continues, and is likely to do so until a market is found for our surplus supplies. Stock owners will be pleased to note that a Committee of Enquiry has been appointed to investigate this matter. In the meanwhile our exports of slaughter cattle to the Union have steadily increased since the beginning of the year, as the following figures show:—January 124, February 242, March 566, April 1,499, May 1,503, June 1,705, July 2,427, August, 2,666—total 10,732. This compares with 7,673 head for the whole of 1921.

The maize crop which is now coming in is estimated to amount to approximately 550,000 bags, or 45 per cent. of the previous year's crop. The acreage yield will, of course, show a considerable reduction. Farmers are busy preparing their lands for the new sowing, which it is anticipated will approximate last year's in extent if the weather conditions are favourable. Tobacco growers are now starting their seed beds in preparation for the season. From the amount of seed sent out by the Department of Agriculture it would appear that there will be a reduction of acreage as compared with last season.

Where it was possible to sow winter cereal crops these appear to have done well, although trouble is experienced in dealing with birds. It is pleasing to note that a leading baker of Salisbury is using an admixture of 90 per cent. flour made from Rhodesian wheat in his bread. This bread appears to be highly satisfactory, as the following testimonial from a lady in a position to judge indicates:—"I have examined and tasted the loaf of bread sent by Mr. Pocket, and find it is equal to that made from the best imported flour." Hitherto it has been considered necessary to re-inforce Rhodesian flour with a considerable proportion of imported flour from hard wheats. There is every reason for believing that we can grow a hard wheat in this country, and thus render it unnecessary to import any flour at all. In view of the fact that our imports of flour and wheat in 1921 amounted to £92,208, there is plenty of scope in this direction.

There has been a brisk export trade of oranges from Southern Rhodesia this season, some 21,000 cases having been sent away up to the middle of September. The prices realised have ranged from 32s. per case at the commencement of the season to 18s. later. The last consignments fetched from 20s. to 25s. per case.

Farming Calendar.

October.

BEE KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolio cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Irrigation should be continued, followed by thorough cultivation, if no good soaking rains occur. From about the middle of this month to middle of next is the best time to plant orange trees, as they have hardened up their first growth, and if properly attended to will commence to grow right away, so that by the end of the growing season they will have put on considerable growth and established themselves well in the ground.

CROPS.

If ploughing has not been done earlier in the season, it should be undertaken as early as the condition of the ground will permit. A disc harrow or a roller should immediately follow the plough in order to break up the clods. In the case of new lands ploughed for the first time earlier in the season, an attempt should now be made to cross plough these. It is not safe or advisable to plant any summer crops during this month except on vlei soils. Winter wheats will be ready for harvesting, and the stubble should be ploughed in as soon afterwards as possible. Green manure crops should then be put in with a view to ploughing these down in December or early January.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize, crops planted late in October are liable to suffer in December from stalk-borer, especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough by December to outgrow serious damage. See "Maize Stalk Borer," *Agricultural Journal*, December, 1917. Cutworms are very apt to be troublesome in the wet vleis. See "Cutworms," *Agricultural Journal*, August, 1918.

Tobacco.—Cutworms, stem-borer, leaf miner and other caterpillars are liable to give trouble in the seed beds. See "Tobacco Pests of Rhodesia," *Agricultural Journal*, February, 1920.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. See "Diseases of the Potato Tuber and Selection of Sound Seed," *Agricultural Journal*, February, 1914. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder) 1 lb. to 30 gallons of water, or (paste) 1 lb. to 15 gallons of water.

THE RHODESIA AGRICULTURAL JOURNAL.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb. Fresh water-slaked lime, 20 lbs. For cabbage aphid wash liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphid (green fly) is troublesome the plants may be sprayed with soap wash or tobacco wash. Leaf eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started the damage is negligible.

Citrus Trees may be sprayed for scale after the fruit has set. Resin wash is the safest and most efficient spray. Fumigation is still more effective. Avoid using miscible oils for citrus spraying at this time of the year. Destroy out-of-season fruit on account of citrus codling moth. See "Rhodesian Citrus Pests," *Agricultural Journal*, February-April, 1916.

Deciduous Fruit Trees, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste) 1 lb. to 10 gallons of water, or (powder) 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is more essential than at first thought, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation. Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

FORESTRY.

Prick out into tins any trees that are ready. If the ground is soft enough, harrow and cross-plough the land broken up in the early autumn.

POULTRY.

The early hatched pullets should now be commencing to lay. They should have been in their laying quarters a month ago in order to get used to them, for any change after they have started will stop them laying. It is much easier to stop a bird laying than to bring her on again, and she will probably go into a partial moult and not get over it for some weeks. If this happens, part of the advantage of early hatching has been lost, for a bird hatched in April, May or June will (if of a good laying strain) commence to lay at from five to six months old, whereas one hatched after August will not lay till she is eight or nine months old.

All houses should be gone over thoroughly this month and made absolutely water-tight as regards sides, roof and floor; it is as well to fill in the last-mentioned to several inches above the surrounding ground, ram it tight and make it smooth and hard, for during the wet season all scratching litter should be put in the house and the birds scratch for their grain there.

See that some shade (very little is required) is provided for the birds during the hot weather, and, above all, that the houses are not hot and stuffy at night, but that ample fresh air without draughts has access.

Turkey hatching should now cease till after the rainy season has finished. Don't try to encourage laying of turkeys during this time; let them all run free in the bush. Those you are going to hatch from next season will lay all the better and produce stronger chicks for the rest, and those that it is proposed to sell for the Christmas market will weigh all the heavier.

Continue hatching ducklings. These thrive during the wet weather as well, if not better, than during the dry, provided they *always* have warm, dry sleeping quarters. Turkey and duck breeders should be on the look-out for Christmas contracts (the early bird always catches the worm); in fact, they should always be on the look-out for steady contracts the year round.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded, if this has not already been done, and care should be taken that they do not suffer any serious set-back by reason of the want of veld. If calves are not desired in mid-winter, the bulls should be taken out of the herd now until the end of January. Care should be taken to provide a plentiful supply of clean water, and dipping must be regularly attended to.

Sheep.—If spring lambs are expected, one should see that the sheep shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the case of late rains. All drinking places should be cleaned out, and care taken that the water supply is sufficient.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and mealies may also be sown this month.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner. The average rainfall in Mashonaland is from one to one-and-three-quarters of an inch; in Matabeleland one inch or so, and rather less in the Zambesi Valley. Generally speaking, the rain is more plentiful and earlier in the eastern districts, and takes the form of thunder showers at this time of year.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month.

The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually-increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

November.

BEE KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally, where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required, artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must still be resorted to, in order to keep the trees in good growth and not allow any check to the fruit. This is the best month to sow beans or other seeds for ploughing in later as green manure. Sow about 75 lbs. of kaffir beans per acre, so as to cover the whole area with a green covering.

CROPS.

This month is one of the busiest on the farm. Planters, cultivators, etc., should be examined and put into order. A great many of the misses in the maize field are undoubtedly due to faulty planting. All seeds should be overhauled, and ground nuts intended for seed are best shelled immediately before planting. Planting and sowing will commence with the rains. Among the first crops to be sown are maize, velvet beans (for seed), ground nuts, dhal and sunflower. Napier fodder roots may be divided if the rains will allow of transplanting.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are very liable to suffer later from stalk borer. Wherever practicable postpone planting until December. See "Maize Stalk Borer," *Agricultural Journal*, December, 1917. Red lands may be baited at the end of the month against surface beetles, snout beetles and other pests which reduce the primary stand of plants. See "Maize Culture on Red Soils," "Value of Poisoned Bait as an Aid to Good Stands," *Agricultural Journal*, April, 1919. Cutworms are not likely to attack the crop badly on red soil until December, but may be in evidence in vleis situations in November. See "Cutworms," *Agricultural Journal*, August, 1918. The black maize beetle will be in evidence on infested farms, but this pest has as yet been imperfectly studied. See "The Maize Beetle," *Agricultural Journal*, February, 1918.

Tobacco.—Practically all the enemies of this crop are apt to be injurious when it is newly planted out. See "Tobacco Pests of Rhodesia," *Agricultural Journal*, February, 1920.

Potato.—The first brood of the leaf-eating ladybirds commences in November. See "Two Ladybirds injurious to Potato," *Agricultural Journal*, October, 1913. Blue blister beetles are frequently a nuisance on sandy soils, and caterpillars may be troublesome. The potato tuber moth is apt to cause injury to the tops at this time of year. An arsenical spray, such as arsenate of lead or Paris green, can be used to check these pests.

Cabbage, Turnip, etc.—Diamond-back moth and webworm are the chief pests, though cabbage aphis may be in evidence (see under October). Liberal watering and washing the plants down regularly with a forceful stream of water from a hose or spray pump helps considerably against the cabbage aphis.

Beans and Peas.—As under October.

Cucumbers, Marrows, etc.—As under October.

Citrus Trees.—As under October.

Deciduous Fruit Trees.—Chafer beetles may still be injurious (see under October). Choice varieties of early peaches may be netted as a protection against fruit-piercing moths.

Fig.—As under October.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to do excellently in this country :—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox, Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

FORESTRY.

Any young plants that are still in the beds should be pricked out into tins in the early part of this month. It is really rather late for this work. If the cross-ploughing and harrowing were not tackled last month, it should be done now.

POULTRY.

Some of the birds will soon commence to moult: some may be doing so already. It is most unprofitable to allow these to take weeks to get through it, or, in poultry parlance, "hang in the moult." Immediately a bird is noticed commencing to drop its feathers it should be placed in another house and run, and fed well. In addition to their ordinary food, these birds should be given, once a day, a mixture of stewed linseed and mealie meal or bran. A dessertspoonful of linseed should be stewed gently in one pint of water, and then mixed with enough mealie meal or bran to make a crumbly food; also to these birds should be given a little more meat or milk than they were formerly getting. To get them through the moult quickly of course means more eggs.

During this and next month diseases of the respiratory and alimentary systems are more prevalent, due to bad housing and sour food, therefore it is necessary to take precautions to prevent these. Coccidiosis, too, is a disease which is more prevalent during the rainy season: again prevention is better than cure, and it is as well to put powdered catechu in the drinking water (half a thimbleful to a quart of water) once or twice a week, especially if birds are known to be dying in the district.

Cockerels destined for the Christmas market should be shut up, fed well and not allowed to take much exercise. An extra feed of soft wet mash (but not sloppy) consisting of mealie meal and milk should be given daily; the additional 2, 3 or 4 lbs. of weight they will put on with this treatment will help them to sell better on the markets. To send in at Christmas, or in fact at any time, old, tough or poorly-fed birds is not conducive to good prices.

Don't pen up turkeys for the Christmas market till a week before despatching, but feed well during this time. A turkey, if penned up too long, pines and loses its appetite and flesh. When selecting for the

Christmas markets, get rid of (in addition to the cockerels) the poor layers and lazy birds. Keep nothing that is unprofitable in the poultry line on the farm.

STOCK.

Cattle.—Normally rains will have fallen and the veld will be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or mealies daily. Dairymen will not require to feed much succulent food, and usually the more expensive protein foods may be considerably curtailed at this time, but good sweet hay and mealies will be found to be very beneficial to milch cows, even if the veld is very plentiful. Clean dry sleeping places for both cows and calves will pay handsomely for any extra trouble involved. Young calves do not need to walk far, and in wet weather are much best in a clean dry pen. Watch for ticks.

Sheep.—Keep the sheep on high dry land. Be careful to keep the ticks down. Be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

TOBACCO.

Continue to sow seed beds, watering, etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out.

Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks, and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkin, mealies, peas and potatoes.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery, gradually gathering to burst in thunder storms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy down pours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows.

In an ordinary season the rainfall is from four to five inches, more in the east and less in the west and in our two great river valleys of the Zambesi and Limpopo. Before the rains commence, severe heat, trying on account of the strong winds and the dryness of the air, is likely to be experienced.

Dates of Meetings of Farmers' Associations, Southern Rhodesia (SUBJECT TO ALTERATION)

DATES OF MEETINGS OF FARMERS' ASSOCIATIONS.

629

Name of Association	Place of Meeting	Secretary	1922			
			October	November	December	
Banket Junction ..	Banket Hotel	Hon. J. B. Parker	7	4	2	
Beairstone District ..	Beairstone Hall, Beairstone	W. Aitken	14	20	28	
Bromley ..	Bromley	G. J. Shirley	16	11	7	
Darwin ..	Arcadia Farm & Mt. Darwin Store alternately	J. W. Goucher	8	12	10	
Eastern Border (South Melsetter)	Good Hope School	J. Tawse-Jollie (<i>pro tem</i>)	No	fixed	dates	
Eastern Districts ..	Enkeldoorn	J. Rademeyer	14	11	7	
Enterprise ..	Enkeldoorn	Geo. Tully	5	2	7	
Enterprise—Guta ..	Enterprise Hotel	J. J. Freer	4	1	6	
Enterprise—Guta ..	Enterprise Hotel	F. W. B. Madhawe	14	22	27	
Enterprise Branch, R. L. and F.A.	Enterprise Hotel	A. S. Will	25	16	21	
Gabaai ..	Hunyani Drift	E. Kelacy-Harvey	21	18	16	
Gatooma ..	Speck's Hotel	A. Seale	14	11	9	
Gasaland ..	Chippinga	W. Wood	14	11	9	
Greystone ..	Various farm houses, Shangani	M. Kerr	14	11	9	
Headlands ..	Royal Hotel, Gwanda	J. G. Edmondstone	28	25	16	
Headlands ..	Headlands	J. D. N. Ntsho	28	25	16	
Hunter's Road Farmers and Stockowners	Hunter's Road Siding	J. Grewar	21	18	16	
Inyanga ..	Shangani	R. W. Twilley	21	18	16	
Inyanga ..	Rhodes Inyanga Estate	M. E. Weale	21	18	16	
Inyanga ..	Inyanga	E. J. Hacking	17	21	19	
Lalapani ..	Lalapani	G. H. Everard	17	21	19	
Maheke ..	Maheke	F. W. Robinson	16	20	18	
Makwiro ..	Makwiro	W. L. McLean	6	No	dates	
Makoni North ..	Makoni South Farm	J. G. Monckton	20	17	15	
Makoni ..	Rusepe	Lionel Dobell	25	29	27	
Marandellas, Northern ..	Marandellas Farmers' Hall	H. Jackson	14	11	9	
Mashonaland ..	Various farm houses	R. S. Arnott	7	4	2	
Mashonaland ..	Imperial Hotel, Salisbury	E. E. Benson	7	4	2	
Mashonaland ..	Various farm houses	G. G. Coghill	5	2	7	
Mazoe ..	Glendale	Mrs. Dudley Davis	No	fixed	dates	
Mazoe Central ..	Mazoe	P. D. Peacey	11	8	13	
Melsetter ..	Melsetter	J. Harvie	7	No	dates	
Melsetter (North) ..	Umtali Hotel, Gwelo	R. V. Vothhouse	17	fixed	dates	
Melsetter and Stockowners ..	Umtali Hotel	A. V. Vothhouse	17	fixed	dates	
Northern Umtali ..	Farm Summerfield	A. Tulloch	6	No	dates	
Norton and District ..	Norton Store	W. Wrench	6	No	dates	
Nyanandlovu ..	Nyanandlovu	G. Graham	No	fixed	dates	
Que Que ..	Que Que	E. J. Ross	21	18	16	
Rhodesian Landowners and Farmers ..	Library Buildings, Bulawayo	H. S. Hopkins	21	18	16	
Salisbury ..	Various farms	H. S. Hopkins	21	18	16	
Salisbury ..	Salisbury	W. C. Gibson	21	18	16	
Shamva ..	Shamva	A. Mussoit	19	16	21	
Umtali ..	Various ranches	Mrs. M. A. Bracewell	19	16	21	
Umtali ..	Royal Hotel, Umtali	J. S. Holland	19	16	21	
Umvuma ..	Umvuma	M. W. Graham	6	3	7	
Umvuma District and Stockowners ..	Umvuma	W. F. N. Thornton	23	25	30	
Victoria ..	Victoria	W. R. Goucher	6	3	1	
Western ..	Plumtree Hotel	W. R. Goucher	14	11	9	

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

DISTRIBUTION OF SEED FOR CO-OPERATIVE EXPERIMENTS.

It is anticipated that seed of the following summer crops will be available for free distribution under the usual terms of co-operative experiments from 1st August until 31st October. After the latter date no further applications for seed of summer crops can be entertained.

The seed is issued free, but the recipient is required to defray all forwarding and railway charges. Sufficient seed of each kind to sow one-quarter to one-half an acre is supplied, and not more than three varieties can be sent to each applicant.

All applications should be addressed to the Chief Agriculturist and Botanist, Department of Agriculture, Salisbury.

Summer Oats.—Sixty day or kherson.

Rice.—Dryland or hill rice (for wet vleis). Imported varieties: Honduras, Fortune and Wartaribune.

Oil Seeds.—Linseed, sunflower, Spanish ground nuts.

Legumes.—White stingless velvet beans, common velvet bean, dolichos beans, sunn hemp (for green manuring), dhal, beggar weed (a valuable dryland substitute for lucerne), lupins (a green manure crop for sandy soil), Black-eyed Susan field pea, Kudzu vine, Tepary bean.

Hay Crops.—Teff grass, Sudan grass, manna, red manna.

Pasture Grasses.—Kikuyu, African Star grass, swamp couch grass, Rhodesian tussock grass, etc., as referred to in the *Rhodesia Agricultural Journal*, April, 1922. (A small number of roots.)

Miscellaneous Crops.—Buckwheat, niger oil (for green manuring), and sweet potato vine cuttings.

BOTANICAL SPECIMENS FOR IDENTIFICATION.

In all cases where a botanical identification is required it is of the utmost importance that the specimens reach the Department of Agriculture in a thoroughly dry condition, free from mildew, and intact, that is not broken in pieces. Whenever possible specimens should comprise main stem or small branch, leaves, flowers, seed vessels and roots or bulbs, though these need not necessarily be on the same plant.

The colour of the flowers and the general form of the plant should be preserved by pressing and drying between two sheets of blotting paper or newspaper. Ordinary plants not excessively succulent can be dried sufficiently in three days, provided the drying papers are changed every day. A heavy weight should be placed on the specimens in order to press them flat.

Correspondents are asked to supply the following particulars as far as possible:—

- (a) height and general appearance of plant or tree;
- (b) class of soil on which found;
- (c) locality and altitude;
- (d) supposed use or properties.

It is advised that specimens be packed between two sheets of cardboard or thin wood, since in this way they will travel long distances without fear of injury.

FARM SEEDS FOR SALE.

The undermentioned seeds grown on the Government experiment farms are offered for sale at the prices quoted. The quantities available are limited. Prices are f.o.r., Salisbury, or f.o.r., the Gwebi experiment farm. Owing to limited supply, the full delivery of any order cannot be guaranteed. Farmers are therefore requested not to enclose cheques until they are advised as to the amount of seed allotted to them. The seed is consigned carriage forward in the case of stations. In the case of sidings, the cost of railage will be notified after despatch. All applications for seed should be addressed to the Chief Agriculturist and Botanist, Department of Agriculture.

Black-eyed Susan pea	25/- per 100 lbs.
Sunflower, black (not guaranteed pure), from selected heads	15/- per 100 lbs.
Kherson oats	30/- per 100 lbs.
Teff grass	9d. per lb.
Manna	4d. per lb.
Red manna	4d. per lb.
Linseed, white flowering	6d. per lb.
Majorda melon seed from selected melons	1/- per lb.
Pumpkin seed from selected pumpkins	2/6 per lb.
Sweet potato slips	10/- per bag

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 218. Useful Measurements for Maize, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 396. Export of Maize.
- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.

- No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 400. Soil Washing, by A. C. Jennings, Assoc.Mem.Inst.C.E.
- No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
- No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia.
- No. 408. The Velvet Bean, by J. A. T. Walters, B.A.
- No. 416. Grasses of Agricultural Importance in Southern Rhodesia, by H. G. Mundy, F.L.S., G. N. Blackshaw, O.B.E., B.Sc., F.I.C., and E. V. Flack.
- No. 417. The Ground Nut or Monkey Nut, by C. Mainwaring.
- No. 422. Improvement of Rhodesian White Maize by Selection, by C. Mainwaring.
- No. 423. The Common Sunflower, by C. Mainwaring.
- No. 428. The Sweet Potato, by J. A. T. Walters, B.A.
- No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
- No. 189. The Manuring of Maize on the Government Experiment Farm. Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
- No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs. Ph.D., B.Sc.
- No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
- No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
- No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
- No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
- No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
- No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
- No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
- No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
- No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.
- No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
- No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
- No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.

TOBACCO.

- No. 148. Darkling Beetle Grubs Injurious to Tobacco, by R. W. Jack, F.E.S.
- No. 168. Report on the Methods of Growing, Curing and Selling Bright Tobaccos in Virginia, U.S.A., by H. Kay Scorrer.

- No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
- No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
- No. 398. Wildfire and Angular Spot.
- No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision),
by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.
- No. 410. Common Mistakes in Growing and Handling Virginia Tobacco,
by H. W. Taylor, B.Agr.
Handbook of Tobacco Culture for Planters in Southern Rhodesia,
price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by
Eric A. Nobbs, Ph.D., B.Sc.
- No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
- No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season
1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.
- No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D.,
B.Sc., and B. Haslewood, F.S.S.
- No. 231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs,
Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 247. Statistical Returns of Crops grown by Europeans in Southern
Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D.,
B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S.,
Statistician.
- No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A.
Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
- No. 286. Statistics of Live Stock and Animal Produce for the Year 1917,
by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and
F. Eyles, F.L.S.
- No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles,
F.L.S.
- No. 361. Statistics of Live Stock and Animal Produce for the Year 1919,
by F. Eyles, F.L.S.
- No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia,
1919-1920, by H. C. K. Fynn.
- No. 393. Statistics of Live Stock and Animal Produce for 1920, by
H. C. K. Fynn.
- No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia
for the season 1920-21, by H. C. K. Fynn.
- No. 426. Statistics of Live Stock and Animal Products for the year 1921,
by H. C. K. Fynn.

LIVE STOCK.

- No. 145. Prospects of Importation of Cattle from Australia, by E. A.
Nobbs, Ph.D., B.Sc.
- No. 208. Water in the Diet of Live Stock, by Ll. E. W. Bevan, M.R.C.V.S.
- No. 211. Fattening of Pigs on Granite Farms in Mashonaland, by
R. C. Simmons.
- No. 227. An Experiment in Beef Production, by R. C. Simmons.
- No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
- No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by
A. G. Holborow, F.I.C., Assistant Government Agricultural
Chemist.
- No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
- No. 255. Pound Fees.

- No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed Farms, by R. C. Simmons.
- No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
- No. 336. Butchering and Flaying.
- No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
- No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
- No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
- No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.
- No. 421. From Breeder to Butcher: Cattle Feeding Experiment No. 9, Government experiment farm, Gwebi, by E. A. Nobbs, Ph.D., B.Sc., F.H.A.S.
- Arsenite Cattle Dip—How to Mix.

DAIRYING.

- No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.
- No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
- No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
- No. 356. Cream and its Production, by T. Hamilton.
- No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 395. Farm Butter Making, by T. Hamilton, M.A., N.D.D., N.D.A.
- No. 401. Milk Records and Milk Testing, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 418. Manufacture of Cheddar Cheese, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 427. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
- No. 95. Oestrus-Ovis in Sheep, by A. King.
- No. 121. Rabies, by Ll. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
- No. 181. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
- No. 202. Distomatosis or Liver Fluke in Cattle and Sheep, by Rowland Williams, M.R.C.V.S.
- No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.
- No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by Ll. E. W. Bevan, M.R.C.V.S.
- No. 324. Infectious Abortion of Cattle, by Ll. E. W. Bevan, M.R.C.V.S. Services of Government Veterinary Surgeons.
- No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.
- No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.
- No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.
- Redwater Treatment and Gall Sickness.

IRRIGATION.

- No. 186. Concrete and Reinforced Concrete, by E. Hardcastle, M.I.E.E.
- No. 206. Hints on Irrigation: Small Earthen Storage Reservoirs, by W. M. Watt.
- No. 270. Odzani River Irrigation Scheme, by W. M. Watt.
- No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.
- No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
- No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.
- No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.
- No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
- No. 419. Irrigation Canals, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E. Engineering Advice.

FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.
- No. 366. The Management of Woods, by J. S. Henkel.
- No. 379. Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds.
- No. 386. Forestry in Rhodesia: Improvement Fellings on the Farm, by J. S. Henkel.

HORTICULTURE.

- No. 75. Fumigation of Fruit Trees with Hydrocyanic Acid Gas, by R. W. Jack, F.E.S.
- No. 354. The Home Orchard, by A. G. Turner.
- No. 424. Citrus Fruit Growing in Rhodesia, by A. G. Turner.

ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
- No. 147. Root Gallworm, by R. W. Jack, F.E.S.
- No. 158. Two Ladybirds Injurious to Potato Plants, by R. W. Jack, F.E.S.
- No. 171. The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants, by R. W. Jack, F.E.S.
- No. 172. Diseases of the Potato Tuber and the Selection of Sound Seed, by R. W. Jack, F.E.S.
- No. 178. Illustrations of Natural Forest in relation to Tsetse Fly, by R. W. Jack, F.E.S.
- No. 187. The Dusty Surface Beetle, by Rupert W. Jack, F.E.S.
- No. 197. Chafer Beetles, by R. W. Jack, F.E.S.
- No. 204. Some Injurious Caterpillars, by R. W. Jack, F.E.S.
- No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
- No. 219. More Household Insects, by R. Lowe Thompson, B.A.
- No. 228. Rhodesian Citrus Pests, by R. W. Jack, F.E.S.
- No. 233. Does it Pay to Spray Potatoes in Southern Rhodesia? by Rupert W. Jack, F.E.S.
- No. 249. Home-made Fly Papers, by Rupert W. Jack, F.E.S., Government Entomologist.
- No. 261. Turnip Sawfly, by R. W. Jack, F.E.S.
- No. 276. The Maize Stalk Borer, by Rupert W. Jack, F.E.S.

- No. 280. The Maize Beetle, by R. W. Jack, F.E.S.
 No. 290. Notes on Remedies for Turnip Sawfly, by Rupert W. Jack, F.E.S.
 No. 291. Cutworms, by Rupert W. Jack, F.E.S.
 No. 302. A Note on the Maize Stalk Borer, by Rupert W. Jack, F.E.S.
 No. 317. Maize Culture on Red Soil; Value of Poisoned Bait as an Aid to Good Stands, by Rupert W. Jack, F.E.S.
 No. 353. Further Experiments with Poisoned Bait on Maize Lands, by R. W. Jack, F.E.S.
 No. 369. The Bean Stem Weevil, by R. W. Jack, F.E.S.
 No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.
 No. 402. Ticks Infesting Domestic Animals in Southern Rhodesia, by R. W. Jack, F.E.S.
 No. 425. A Newly Recorded Pest of Maize: "Rootworm," by R. W. Jack, F.E.S.

POULTRY.

- No. 377. The Fowl Tick, by A. Little.
 No. 406. The Turkey, by A. Little.
 No. 415. Mating for Improvement and Increased Egg Production, by A. Little.
 No. 420. Poultry Husbandry: Housing and Feeding of Adult Fowls, by A. Little.

MISCELLANEOUS.

- No. 93. Formation of Agricultural Credit Associations in Rhodesia, by Loudon M. Douglas, F.R.S.E.
 No. 226. Classification of Clouds, by R. H. Scott, F.R.S.
 No. 254. Hints on Explosives, by W. M. Watt.
 No. 264. Nature Notes—Adaptation, by C. F. M. Swynnerton, F.L.S.
 No. 273. Enkeldoorn Produce Express Syndicate Rules.
 No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.
 No. 283. Maize Foods for the Home.
 No. 294. Directions for taking Samples for Analysis, by E. V. Flack, Acting Agricultural Chemist.
 No. 318. Notes on Mining Law for Farmers, by Advocate D. E. McCausland, M.A., LL.B.
 No. 358. Notes on the Regulations governing the Sale of Fertilisers and Farm Foods, by E. V. Flack.
 No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
 No. 391. Hints on Brickmaking, by G. T. Dyke.
 No. 414. Limestones in Southern Rhodesia, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
 Malarial Fever: How it is caused and how it may be prevented, by Sir Ronald Ross, F.R.C.S., D.Sc., LL.D., F.R.S., K.C.B., etc.
 The Analyses of Agricultural Products, Soils, Water, etc.
 Lectures for Farmers.
 Farming Returns for Income Tax Purposes.

Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 331 of 1922.]

[28th July, 1922.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to declare, in terms of section 17 of Government Notice No. 21 of 1917, the following areas of infection and guard area:—

NATIVE DISTRICT OF MELSETTER.

(a) *Areas of Infection.*

The farms Randfontein, Avontuur, Nooitgedacht, Merino, Smaldeel, Sable Home, Bamboo Creek, Hermit, Umzelezwe and Elandsberg.

(b) *Guard Area.*

That portion of the native district of Melsetter lying south of and including the Ngorima Reserve, the farms Uitkyk, that portion of Voorspoed south of Lusita River, Sterkstroom, Fortuna, Waterfall, New Year's Gift, Buffel's Drift and Tanganda River.

No. 357 of 1922.]

[11th August, 1922.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to amend Government Notice No. 555 of 1921 by deleting the latter portion of the Notice declaring an area of infection and guard area in the Melsetter and Umtali native districts.

No. 362 of 1922.]

[11th August, 1922.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 180 of 1922, declaring an area of infection and guard area in the Matobo native district.

No. 391 of 1922.]

[1st September, 1922.

AFRICAN COAST FEVER.

WHEREAS there has been an outbreak of destructive disease—to wit, African Coast Fever—on the farms Wiltshire and Worcestershire Estates, Swartfontein, Chipisa and Mooifontein, in the Charter and Chilimansi districts, His Honour the Administrator in Council has been pleased, under

the powers vested in him by the "Animals Diseases Amending Ordinance, 1911," to declare the following area to be actively infected with African Coast Fever for the purposes of the said Ordinance.

Description of Area.

HARTLEY, MARANDELLAS, CHARTER, CHILIMANZI AND
GUTU NATIVE DISTRICTS.

An area bounded by and including the farms Palmiet Vlei, Mserenge, Glynn, Bucknall, Sunnyside, Balmoral, Corfe, Par, Clanwilliam, Beer, Lovedale, Pilgrim's Rest, Mizpah, Wedge, Hopley's, Skipton, Imboga, Goto and Rundu; thence down the Sabi River to its junction with the Rumwengi River; thence up the latter to its headwaters; thence in a south-easterly direction to the headwaters of the Nyamhonga River and down this river to its junction with the Nyadzidza River and up the latter to Eastdale East; thence by and including Eastdale East and Eastdale Estate, but excluding that portion of the latter lying south of the Gutu road; thence by and including Widgeon, Shasha Fountains, Driefontein B, Sessebi and Chakastad; thence along the northern boundary of the Chilimanzi reserve and along the boundaries of the Chilimanzi and Charter native districts to the farm first named.

No. 392 of 1922.]

[1st September, 1922.

AFRICAN COAST FEVER: COMPULSORY DIPPING OF CATTLE.

HIS Honour the Administrator in Council has been pleased, under the provisions of section 7 of the "Animals Diseases Consolidation Ordinance, 1904," to declare that, within the area defined below, on and after the date of publication hereof, every owner of cattle shall cause the same to be dipped in a dipping tank so constructed as to permit of total immersion of cattle at such intervals and in such solutions as the Controller of Stock shall direct.

Description of Area.

HARTLEY, MARANDELLAS, CHARTER, CHILIMANZI AND
GUTU NATIVE DISTRICTS.

Guard Area.

An area bounded by and including the farms Palmiet Vlei, Mserenge, Glynn, Bucknall, Sunnyside, Balmoral, Corfe, Par, Clanwilliam, Beer, Lovedale, Pilgrim's Rest, Mizpah, Wedge, Hopley's, Skipton, Imboga, Goto and Rundu; thence down the Sabi River to its junction with the Rumwengi River; thence up the latter to its headwaters; thence in a south-easterly direction to the headwaters of the Nyamhonga River and down this river to its junction with the Nyadzidza River, and up the latter to Eastdale East; thence by and including Eastdale East and Eastdale Estate, but excluding that portion of the latter lying south of the Gutu road; thence by and including Widgeon, Shasha Fountains, Driefontein B, Sessebi and Chakastad; thence along the northern boundary of the Chilimanzi reserve and along the boundaries of the Chilimanzi and Charter native districts to the farm first named.

No. 393 of 1922.]

[1st September, 1922.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 555 of 1921, declaring an area of infection in the Melssetter native district.

RHODESIA **Agricultural Journal.**

ISSUED BY

**The Department of Agriculture,
SALISBURY, RHODESIA.**

ADVERTISEMENTS.

The Journal is issued every alternate month.

Application for advertising space should be addressed to the Editor. The rates are as follows, *per issue* :—

Position.	Whole page.			Half page.			Quarter page.		
	£	s.	d.	£	s.	d.	£	s.	d.
Inner pages	2	8	0	1	10	0	0	18	0
Outer cover (back)	4	16	0	—	—	—	—	—	—
Inner covers (back and front)									
and page facing Contents	3	12	0	2	2	0	1	4	0

A discount of 10 per cent. will be allowed for standing or consecutive advertisements running through six issues. Remittances, and electros where desired, should accompany orders. The right is reserved to discontinue the insertion of standing or consecutive advertisements should payment beyond the second issue be delayed.

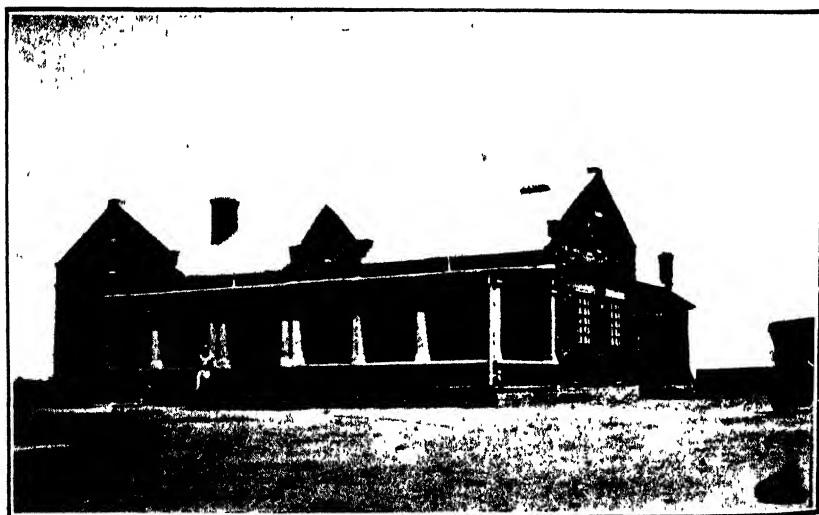
The right of approval of all advertisements by the Director of Agriculture is reserved, and his decision as to the acceptance or rejection is final.

An additional charge may be made for advertisements printed in special type, equal to any additional charges made by the printers for setting up same.

Advertisements will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words.



Mrs. Boright's homestead, Inunwa Ranch, Bubi.



V. Merandon's homestead, Kodhwayo Ranch, Bembesi.



THE RHODESIA
Agricultural Journal.

Issued by the Department of Agriculture.

PUBLISHED BI-MONTHLY.

Subscription : 5/- per annum.

VOL. XIX.]

DECEMBER, 1922.

[No. 6.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

Cattle Industry Committee of Enquiry.—The committee appointed by the Administrator to enquire into the position of the cattle industry held a preliminary sitting in Salisbury early in November, and will sit at other times and places as will be announced. Its members are Dr. E. A. Nobbs, chairman, and Messrs. M. F. Cleveland, C. S. Jobling, H. U. Moffat and O. C. Rawson, with Mr. Bertram Woods as secretary. The points referred for enquiry are: (1) quantity and quality of cattle available for export, (2) markets, (3) the development of export trade, and (4) prospects of the industry. It is to be hoped the committee will be successful in collecting a body of evidence on these points of such a nature that they may be able to make useful recommendations directed towards an improvement of the industry.

The Committee desires to obtain evidence from farmers and others interested, and especially from those having knowledge of any particular branch of the subject. Such evidence may be given verbally or by a written statement, the latter to be, if necessary, supplemented by an interview. In order that further sittings of the Committee may be arranged, any person wishing to give evidence is requested to communicate with the Secretary of the Committee, care of Department of Agriculture, as soon as possible. Subsequent interviews will be welcomed by the Committee.

African Coast Fever Enquiry.—The following gentlemen have been appointed as a committee to enquire into and report on recent outbreaks of Coast Fever.—Mr. A. E. Speight, chairman, and Messrs. J. A. Edmonds and James Struthers. The committee will investigate the circumstances attending outbreaks of the disease in Charter and Chilimanzi districts, will report on the adequacy or otherwise of measures used to prevent the spread of the disease, and generally report on the manner in which the Cattle Cleansing Ordinance of 1918 is carried out.

The Mtao Forest Reserve.—The Government has purchased for forestry purposes the tract of land known as the "Mtao Reserve," approximately 6,210 morgen in extent, situated in the Chilimanzi district. The Gwelo-Fort Victoria railway passes through the area for a distance of 6½ miles. The geological formation is Kalahari sand, and it is interesting to note that this is the most easterly outlier of the formation which occupies so large an area in the western parts of the Territory. The soil is deep and eminently suitable for a State afforestation scheme. It is proposed to grow on this reserve a wide range of both hard and soft woods. Eventually the planted area will be about 5,000 morgen in extent. During October operations were commenced at Fairfield Siding. A nursery is being established for the supply of seedlings and transplants to farmers in the Midlands under the management of Mr. F. B. Willoughby.

It is hoped that the action of the Government in launching its first large afforestation scheme will be supported by all sections of the community. The demand for timber is constantly increasing, and it is only by the co-operation of the land-owners of the country that it will be possible to supply local industries with the timber they need.

An Additional Poultry Expert.—The appointment of Mr. H. G. Wheeldon as Assistant Poultry Expert in the Department of Agriculture will no doubt give much satisfaction to farmers and poultry keepers, as the need of such an appointment has for some time been realised. Mr. Wheeldon, who was selected out of a large number of applicants for the post, has arrived and commenced duty. He has come to Rhodesia from the Transkei, where he was lecturer on poultry and agriculture and

vice-principal at the Teko Agricultural School, previous to which he had considerable experience in itinerant poultry instruction to farmers in the Union and at the schools of agriculture there. Originally he was a student under Mr. Little and then his assistant, and now he again joins him in Rhodesia.

Farm Food Prosecution.—Recently, at the Magistrate's Court, Salisbury, a case of interest to farmers was tried in which a manufacturer was fined £3 for failure to register certain farm foods sold by him, as required under the Ordinance providing for the control of fertilisers, farm foods and pest remedies. This conviction will, it is hoped, help to remind all merchants and manufacturers of these classes of goods of the need for compliance with the law. The aim of this law is the protection of the farmer and the honest dealer alike by permitting only the sale of registered foods and fertilisers, the composition of which is guaranteed by the vendor and is subject to control by the Government.

Farmers in buying either artificial manures or foodstuffs should insist on receiving a copy of the guaranteed composition which by law the vendor is required to furnish to them.

The Ordinance only defines as farm foods falling within its scope certain classes of artificially prepared feeding stuffs, and excludes unmixed meal made directly from entire grain, also unmixed bran, dog food, poultry food, brewers' grains and so forth. Farmers and dealers alike should make themselves conversant with the provisions of the law.

Cattle Cakes and Meals. The value to feeding stock, particularly to milch cows, bulls and fattening oxen, of the residues of our brewing, milling and oil industries has as yet been hardly appreciated by our farmers, and certainly has not yet been adopted to anything like the extent which is warranted, or which will one day be the case. It is not in every instance possible or advantageous to grow all the concentrates required for stock on the farm. Often it may be more advantageous to sell the crop and replace it with the manufacturers' by-products, and certainly this will be the case when these commercial undertakings increase their output and are in a position to offer the residues at really low prices. This position is fast approaching; indeed certain of our stock foods are offered at figures comparing favourably with present European prices, which, however, are altogether too high in proportion to farmers' profits, owing, we are told, to industrial conditions.

In this connection it is somewhat unfortunate that amongst those who already use these products a tendency has arisen to confuse the terms cake and meal. This is due to the fact that the first, and for a long time the only, so-called cake produced in Rhodesia was that made from ground nuts by the press now run by the Farmers' Co-op. Industries, Ltd., Salisbury. This product took the form of a very soft cake

which so readily crumbled to powder that it was sold not in the original form, but in sacks containing a meal with fragments of cake amongst it. From this farmers not having experience of cake in other countries have come to speak of meal as cake. This is misleading. In Europe cattle meals are often preferred to cattle cakes. The advantage of the meal form of concentrated cattle food lies chiefly in avoidance of all necessity for cake breakers, a relatively expensive piece of machinery of use only for the one purpose of reducing to small lumps and meal the original cake. Further, meals can very conveniently be mixed with other food, such as silage, chaffed hay, pumpkins or grain, and meal is readily weighed or measured in any precise ration desired and is easily carried about in sacks.

Cake, on the other hand, is in a clean, firm form readily stored, and cannot after manufacture be illicitly adulterated.

The feeding value of a cake or meal does not depend upon its form, but upon its actual composition as determined by analysis, which has, by law in the Union and in Rhodesia, to be supplied by the seller to the buyer, and not only at his demand, but obligatorily and with every purchase.

The value of a farm food depends then upon its composition and condition. The former has to be guaranteed; the latter is a question largely of moulds or decomposition, due to faulty storage or defects in the original materials, and is avoidable by proper care and attention. Whether the farm food is in the form of a cake or a meal is a secondary consideration perhaps, but there is a distinct difference in the nature and quality of meals and cakes and no justification for confusing them. All oil-cakes are the result of compression, and most oil-meals are the result of extraction of oils by chemical solvents, a much more complete process, leaving the residue correspondingly poorer in fats, a fact which emerges in the guarantee of composition. Meals may also be made from non-oleaginous products, such as bran, beans, offal grain and even meat, or of mixtures of these with oil seed or germ from which the fats have been more or less completely removed. There should, therefore, be no prejudice against meals as such compared with cakes. Each may be good or bad of its kind, and both, if good, can with advantage be more largely used than has hitherto been the practice of our farmers.

The First Rhodesian Tobacco.—It will hardly be realised by tobacco growers in Southern Rhodesia, where last year 3,746,982 pounds of leaf were grown by farmers, that the industry this year already attains its twenty-first birthday. So far as we can ascertain, the following extract from the proceedings of the Rhodesia Scientific Association, dated 27th March, 1901, is the earliest record of tobacco being grown by a European in the Territory, although of course it has been cultivated since time immemorial by the natives.

The experimenter had of course no previous experience to guide him, and, in the light of present-day knowledge, his remarks in regard to fertilisers and curing are not to be accepted or recommended, but

the credit for the pioneer effort appears to be due to Mr. Evans. No farm of the name of River View is shown on the map anywhere near Filabusi, but perhaps Fairview, on the Insiza River, is meant. The passage in the proceedings referred to reads as follows:—

“A specimen of tobacco grown in Rhodesia was exhibited, upon which Mr. Cregoe made the following remarks:—

“The exhibit of tobacco was grown and prepared by Mr. R. J. Evans, of River View, Filabusi, from Virginia seed, which was sown in October last and harvested in the early part of the present month (March). It was grown near the river, the soil being a sandy loam and the plants about 3 feet apart.

“It may be thought that such an exhibit is not altogether suitable for the meeting of a Scientific Association, but when the necessary requirements to grow the plant with success are considered, it must be recognised that this cannot be carried out successfully except by long and tedious experiments, unless with the aid of science in the form of chemistry. The tobacco plant requires a large amount of lime and potash in order to make the leaves burn well. In the analyses of soils which have been made in some districts of the Cape Colony a sufficiency of lime and potash has been found, but at the same time large quantities of chlorine compounds. Chlorides increase the quantity of the production, but impair the quality and interfere with its combustibility; this shows how essential it is for the farmer who purposes engaging in the cultivation of this or any other class of agriculture to have a careful analysis of his soil made before starting with his work. The colour of the exhibit is said by connoisseurs of the weed to be rather dark. This can easily be remedied by, in future, carefully subjecting the leaves to the American green-sweating process, which, it is asserted, will produce tobacco of a nice yellow colour.’ ”

Appointment of Botanist.—The botanical work of the Agricultural Department has hitherto been carried out by Mr. H. G. Mundy, Chief Agriculturist, and his assistant, Mr. J. A. T. Walters, but the calls upon the time of these officers for administrative work, the management of experiment stations, and the touring of the country in advisory capacity have increased to an extent which makes it necessary to relieve them of more purely botanical investigation. Also it has long been recognised that plant diseases affecting crops in Rhodesia require special attention and study, with a view to their control. For these reasons it has been decided to appoint an officer who shall devote the whole of his time to botanical work. This post has been given to Mr. F. Eyles, F.L.S., who has been for some years in the service of the Department in other capacities. Mr. Eyles will shortly proceed to the Union, where he will spend several months in completing certain special studies for which no facilities at present exist in Rhodesia. At the end of June, 1923, he will take up his duties here, which, in addition to the labour of collecting and identifying the native plants of the country, will include the special study of plants of economic importance and the investigation of local diseases of plants.

Dipping Tanks.—A useful device in connection with new or existing tanks consists of a small concrete or cement-lined brick tank connected with the water inlet, to allow of the mixing of fresh solution of standard strength in a simple manner. Thus, if a dip of 1 in 400 is in use, this filling tank should be made of that capacity—viz., 4 feet x 4 feet and 4 feet—and 1 gallon of dip poured into 400 gallons of water before this is added to the dipping tank. Marks on the sides can be made for other strengths. In view of the frequent cases of arsenical poisoning which occur and the need for dips being kept at effective strength, any plans for controlling this work are of importance. This does not, however, provide for the rectification of dipping solutions which are too strong or too weak.

Another device to secure economy when cleaning out the tank is to pour the dip into such a filling tank and other vessels, even using the dripping race and any inequalities in rock floored kraals and so on in which the liquid can be stored, and, after the sediment has settled and the deposit in the tank itself been cleaned out, this liquid can be returned to the tank, its strength tested, and the tank then filled up with fresh solution accordingly.

Frequent skimming of hair and scum and dragging of the bottom of the tank greatly prolong the intervals between the necessary but costly process of emptying and renewing.

There is considerable waste in many tanks from splash and loss of dip, which in the aggregate and in the course of time amounts to a serious loss. This loss could readily be saved or much reduced by a few courses of brick, adequate ridges round the dipping pen and sufficient space to dry the stock in before letting them out. A foot-bath in the entrance race saves much dirt from getting into the tank. Attention to these details is becoming more and more worth while, as the numbers going through our tanks continue steadily to increase.

Farming Profits.—In these days of cut profits our farmers have to look to a finer margin between prices and cost of production than has obtained in the past, and, on the other hand, must turn to account the side lines and minor products neglected when returns were high.

To-day lemons, formerly allowed to rot, go to the mines; skins and hides previously left on the carcase are flayed and dried, and reims are brayed, not bought; poultry has become an important source of income; bacon is home cured. In these and other ways sound economy is being practised, and local markets are receiving more attention. Secondary products are the concern of the manufacturers, but so far as they contain locally grown products, as in the case of bacon and ham, soap, oil, candles, maize derivatives and the like, it is very much to the interest of the farmers to see them getting a ready sale by using them themselves and urging others to consume local products in preference to imported articles.

Botanic Garden, Salisbury.—At this season of the year, when plants can safely be transplanted from veld to garden, we desire to remind our readers that the Salisbury Town Council has set aside a piece of land for the establishment of a Botanic Garden, in which it is hoped that all the most beautiful trees, shrubs and flowers native to Southern Rhodesia may be assembled and grown. The accomplishment of this design will take years, and in a sense will never become so complete that additions cannot be made, but the rapidity with which the ground can be filled with ornamental and interesting plants is dependent upon the amount of help given to the scheme by residents in the outside districts. It may appear that the garden is for the benefit of Salisbury chiefly, but we believe it will become a centre of attraction for visitors from the country and from abroad, especially on account of its unique character in that it will contain only plants indigenous to Southern Rhodesia. We therefore appeal to farmers and others living in the country to remember the National Botanic Garden when they are moving about the veld, and to send in anything they see that may be remarkable for beauty or size, or that seems to be curious or uncommon. The collector will be put to no expense, for all he needs to do is to gather seeds of trees, dig up roots or bulbs of smaller plants, pack them in a box or sack, and consign them to the Stationmaster, Salisbury, for the Botanic Garden, rail carriage free. Contributions will be specially welcome during the next two months, so that plants received may be well established before the end of the rains. Arrangements are being made to affix plain, permanent labels to the plants now in the garden, giving their names, and it is proposed shortly to publish a list of what is there, so that persons willing to assist will realise how much is still needed. Any one forwarding plants is requested to send his name to the Director of Agriculture, in order that all contributions may be duly acknowledged.

Rhodesian Milk Records.—Elsewhere in this issue will be found a table containing the Rhodesian milk records received to date. It is encouraging to note that several new owners have sent in returns and that a new settler who has supported the scheme since its inception writes: "These milk records are invaluable. I am the only farmer in the district who has dairy produce for sale and I have been able to sell everything I produce at a good profit." The outstanding cow in the list published is Mr. J. A. Baxter's Friesland cow "Begonia," which the owner purchased at Salisbury Show sale. This cow has been milked three times a day and has given no less than 3,564 lbs. of milk in sixty days, or an average of approximately six gallons per day. The cow is only four years old, and we can therefore expect a much greater return in future lactations.

The Possibility of Seasonal Forecasting and Prospects for Rainfall Season 1922-23.

By C. L. ROBERTSON, B.Sc., A.M.I.C.E., Hydrographic Engineer.

The question of the possibility of forecasting the approximate nature of the coming rainfall season is one which is of great interest to farmers, and more particularly so at the present time in view of the serious shortage in the rainfall last season after very promising early rains.

The problem is one which has largely of course engaged the attention of meteorologists. It has been generally admitted in recent years that more should be attempted in this direction, and that an approximate solution which will be appreciably correct in the majority of seasons would be of considerable value to all those dependent on weather conditions, even admitting the possibility of a considerable margin of error in certain individual seasons.

The problem is one which, by its nature, does not admit of an exact solution, and the possible error is increased with only a short period record such as is available here. Owing to the comparatively regular procession of the different types of the rainfall seasons in tropical and sub-tropical regions, the problem in this country is somewhat simpler than it would be for a country in the temperate zones. A seasonal forecast of the monsoon rains in India has been issued for some years. The Indian estimate has been framed from certain other prior factors which have been proved to have a connection with the Indian rainfall in the succeeding monsoon season, and the extent of this connection expressed in the form of a general equation embracing all these factors. In the Dutch East Indies a seasonal forecast is also issued, but in this case it is framed from the trend of the mean rainfall curve, which is a very regular one.

In the estimate as framed below both these methods have been followed, the one serving as a check on the other. The results of the investigation as outlined below were communicated to the Meteorological Office, London, for an authoritative opinion as to their value in seasonal forecasting. The Director, Dr. Simpson, who was formerly in charge of the Indian Meteorological Service, remarks:—"The results are very

interesting and suggestive, and appear to be sufficiently definite to warrant the investigation being continued. The number of years available at present, twenty-three, is rather small for the purpose, but every year that is added will increase the value of your results." Mr. C. E. P. Brooks, who examined the figures in more detail, points out that the probable error of the forecast arrived at by this method is 3.7 inches, which means that one year in two the error of the forecast will exceed 3.7 inches.

The reader will therefore realise that there are certain very definite limitations to the accuracy of the figure estimated, yet it will be interesting to see how far actual results verify the conclusions arrived at. In any case the analysis of the probabilities of the season as given below will be of more weight than any individual opinion, and in the majority of seasons, it is believed, will prove of some practical value.

Connection between Rhodesian Rainfall and other Factors.—

The following factors have been compared during the period 1899-1922.—

Deviation from normal of mean Rhodesian rainfall and

- (a) Deviation from normal of mean flood height of Blue Nile at Khartoum during previous August and September.
- (b) Deviation from normal of mean rainfall India S.W. monsoon rains during previous June to September.
- (c) Deviation from normal of mean rainfall Rhodesia four seasons previous.
- (d) Deviation from normal of barometric pressure at Bulawayo during previous June to September.
- (e) Deviation from normal of mean temperature at Bulawayo previous June and July.
- (f) Deviation from normal of mean temperature at Bulawayo previous August and September.

It was found that the connections between factors (d) (e) and (f) and the mean Rhodesian rainfall in the following season were very slight, or in other words the meteorological conditions existing here locally during the preceding winter and spring do not appear to be reliable guides as to the nature of the rainfall season. These factors need not therefore be considered in the general equation.

Blue Nile Flood and Indian S.W. Monsoon Factors.—The following table shows the deviations from normal of the mean height of the Blue Nile at Khartoum during August and September and the Indian S.W. monsoon rains during June to September compared to the deviation from normal of the mean Rhodesian rainfall during the succeeding October to March.

TABLE I.

Year.	Deviation Blue Nile flood height. Decimetres.	Deviation Indian rainfall. Inches.	Season.	Deviation mean Rhodesian rainfall. Inches.
1899	- 5.3	- 6.73	1899-1900	+ 0.73
1900	+ 3.6	+ 0.52	1900-01	+ 5.16
1901	+ 2.5	- 4.70	1901-02	+ 4.84
1902	- 4.7	+ 0.83	1902-03	- 5.66
1903	+ 3.6	+ 0.25	1903-04	+ 2.74
1904	Normal	- 1.09	1904-05	- 6.91
1905	- 4.2	- 3.49	1905-06	- 4.33
1906	+ 4.5	- 1.80	1906-07	+ 6.88
1907	- 7.9	- 3.12	1907-08	- 1.04
1908	+ 8.4	+ 2.07	1908-09	+ 5.14
1909	+ 7.4	+ 2.03	1909-10	- 4.37
1910	+ 2.8	+ 1.69	1910-11	+ 4.40
1911	+ 2.3	- 3.90	1911-12	- 6.28
1912	- 1.5	- 1.74	1912-13	- 6.29
1913	- 16.8	- 1.88	1913-14	- 10.73
1914	+ 1.1	+ 3.40	1914-15	+ 13.30
1915	- 8.8	- 3.00	1915-16	- 10.44
1916	+ 7.2	+ 5.02	1916-17	- 3.69
1917	+ 8.5	+ 7.14	1917-18	+ 19.13
1918	- 4.2	- 6.48	1918-19	+ 2.63
1919	+ 0.8	+ 3.26	1919-20	+ 3.32
1920	- 2.9	- 4.31	1920-21	+ 2.56
1921	- 1.4	+ 1.41	1921-22	- 11.01

The curve on accompanying plate shows graphically the intimate connection between the variations in the height of the Nile flood and Rhodesian rainfall. Expressed arithmetically, the following relationship holds between these factors:—

R being probable deviation of Rhodesian rainfall from normal in inches, and x_1 being deviation from normal in decimetres of mean height Blue Nile,

$$\text{then } R = + (0.70 \pm 0.17) x_1$$

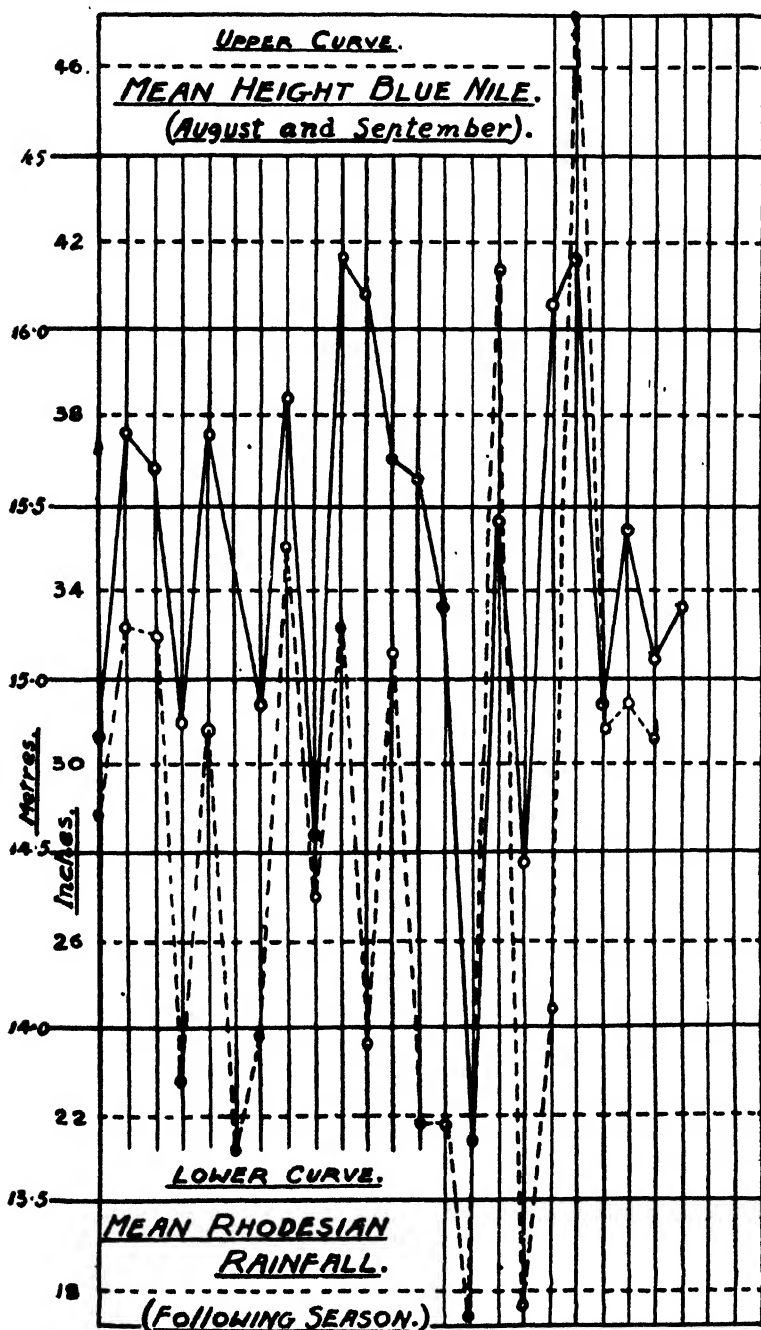
and if x_2 is the deviation from normal of Indian S.W. monsoon rains,

$$\text{then } R = + (0.74 \pm 0.38) x_2.$$

But, as there is also a close connection between the Blue Nile flood height and the Indian rainfall, the effect of one of these factors would be almost wholly neutralised if it is used in the general equation, the relationship in this case being expressed by

$$x_1 = + (1.03 \pm 0.10) x_2.$$

As the mean height of the Blue Nile is readily obtainable from Egypt by the end of October each year, whilst the Indian rainfall figures are not available so early, it has been decided to utilise only the Nile factor in the general equation.



Rhodesian Rainfall Four Seasons Previous.—An examination of the smoothed curves of Salisbury and Rhodesian rainfall on plate attached will show that there is a marked tendency for successive maxima and minima to be spaced four seasons apart.

This tendency is also shown, but to a lesser extent, if individual seasons are considered, as will be seen by comparing seasons 1899-1900 and 1903-04, 1900-01 and 1904-05 and so on in Table I. In the bulk of cases an above or below normal season is followed by a season of the reverse type four years later.

If x_3 represents deviation of Rhodesian rainfall four seasons ago, then the following relation holds:—

$$R = - (0.33 \pm 0.20) x_3.$$

This is not an entirely satisfactory connection, but is the only factor available from our present short period record. Later on the type of season prevailing nineteen years ago will probably be the much more satisfactory one to employ.

There are a number of other factors which might be usefully investigated for their effect on Rhodesian rainfall, but time has not permitted of this being done, and for the present these factors must suffice.

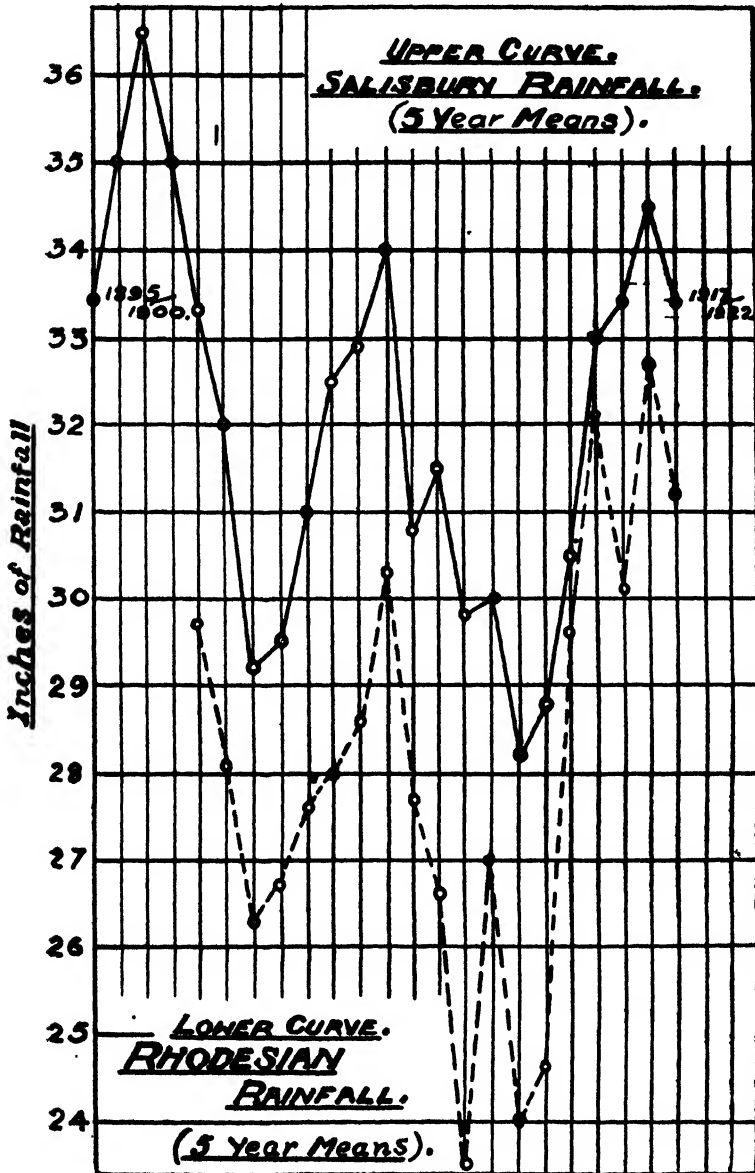
The general relationship is then expressed by the equation—

$$\text{Mean rainfall Rhodesia succeeding season} = 28.1 + 0.63x_1 - 0.19x_3.$$

The following table shows a comparison between mean rainfall in Rhodesia, calculated according to this equation, and the actual rainfall experienced during period 1903-22:—

TABLE II.

Season.	Calculated rainfall.	Actual rainfall.
	Inches.	Inches.
1903-04	30.2	30.85
1904-05	27.1	21.20
1905-06	24.5	23.78
1906-07	32.0	34.99
1907-08	23.2	27.07
1908-09	34.7	33.25
1909-10	33.6	23.74 x
1910-11	28.6	32.51
1911-12	29.8	21.83 x
1912-13	26.1	21.82
1913-14	18.4	17.38
1914-15	28.0	41.41 x
1915-16	23.8	17.67
1916-17	33.8	24.42 x
1917-18	35.5	47.24
1918-19	22.9	30.74 x
1919-20	30.6	31.43
1920-21	27.0	30.67
1921-22	23.7	17.10



The normal mean rainfall of Rhodesia is 28.1 inches. It will be noticed, therefore, in the above table that there are only five seasons on which, if an above or below normal season would have been forecasted, the resulting season would have seriously differed from the forecast.

Forecast for 1922-23 Season.—The factors available for this season are the following:—

Mean height Blue Nile August and September, 1922, 1.7 decimetres above normal.

Mean rainfall, Rhodesian season 1918-19, 2.63 inches above normal.

Therefore

$$\text{Mean rainfall this season} = 28.1 + (0.63 \times 1.7) - (0.19 \times 2.63) \\ = 28.7 \text{ inches.}$$

That is, this reasoning goes to show that this season's rainfall over the country generally should be approximately normal.

It remains to be seen whether there are any indications possible for its probable distribution over the country, and also whether there are any other factors tending to confirm above result.

Smoothed Rainfall Curves for Salisbury and Rhodesia.—The smoothed rainfall curves for Salisbury and Rhodesia are shown on the accompanying plate. They have been obtained from the average rainfall for each block of five years, *e.g.*, 1899-1904, 1900-05, and so on.

The extremely regular character of the Salisbury curve is very apparent, and it will be noticed that there is a period of nineteen years between major maxima and subsidiary periods of nine and ten years between successive maxima and minima.

The curve for mean Rhodesian rainfall also closely approximates to the general character of the Salisbury curve for the shorter period available. In addition to this nineteen-year period appearing in the smoothed curve, its effect is also seen if a comparison is made between rainfall recorded nineteen seasons apart, as shown by the following table:—

TABLE III.

Season.	Rainfall, Inches.	Season.	Rainfall, Inches.	Season.	Mean Rhodesian rainfall. Inches.	Season.	Mean Rhodesian rainfall. Inches.
1895-96	34.94	1914-15	33.42				
1896-97	29.06	1915-16	23.49				
1897-98	27.48	1916-17	26.08				
1898-99	37.91	1917-18	41.39				
1899-1900	36.92	1918-19	36.52	1899-1900	28.84	1918-19	30.74
1900-01	38.85	1919-20	34.35	1900-01	33.27	1919-20	31.43
1901-02	34.73	1920-21	36.63	1901-02	32.95	1920-21	30.67
1902-03	21.72	1921-22	17.79	1902-03	22.45	1921-22	17.10
1903-04	30.60	1922-23	(?)	1903-04	30.85	1922-23	(?)

It will be noted that if this factor is considered it would tend to correct the inaccurate results obtained from the general equation in seasons 1916-17 and 1918-19, and confirm the results in the other seasons.

The number of occasions available is, however, still too small to entitle this factor being utilised in the general equation.

Treating the relationship as a separate factor and assuming it will prevail this season, we obtain the result that rainfall in Salisbury this year will probably be 29 inches, or 3 inches under normal, whilst mean rainfall over the whole country will probably be 30 inches, i.e., 2 inches above normal.

This, therefore, tends to confirm the result arrived at from general equation, and points to a slightly under normal season in Northern and Western Mashonaland (Zones C and D).

In the other portions of the country, therefore, the rainfall will probably tend to be above normal, more particularly in Southern Matabeleland and South-Eastern Mashonaland (Zones B and E).

To conclude this necessarily imperfect analysis, which is put forward with some diffidence as being merely a tentative attempt to utilise available data, although the period of our records may appear rather short to justify any such attempt, I will summarise the conclusions as follows:—

Summary.—(a) It appears probable that the mean rainfall over the whole Territory will be slightly above normal this season. (b) The mean rainfall in the northern and western portions of Mashonaland appears likely to be somewhat under normal, and above normal in Southern Matabeleland and South-Eastern Mashonaland.

Since the above was written, it has been notified that the Indian S.W. monsoon rains this season were 1.8 inches above normal. The general equation to include this factor is:—

$$R = 28.11 + 0.07 x_1 + 1.22 x_2 - 0.65 x_3$$

and the result arrived at for this season's rainfall is 28.7 inches, which agrees closely with the estimate arrived at from two factors only.

Annual Report of Crop Experiments, Gwebi Experiment Farm, 1921-22.

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist.

On the Gwebi Farm (as elsewhere) the season proved the worst on record, the rainfall not only being abnormally scanty, but very unfavourably distributed. Early rains were good, and all crops sown or planted prior to the middle of December were got in under favourable conditions. The rainfall in detail was as follows:—

September ...	.10 in.	(1 day)	February ...	7.17 ins.	(9 days)
October ...	1.34 ins.	(5 days)	March ...	1.12 ins.	(5 days)
November ...	2.46 ins.	(5 days)	April ...	Nil	
December ...	5.16 ins.	(11 days)	May ...	.47 in.	(2 days)
January ...	.62 in.	(2 days)	Total ... 17.44 ins.		

The two January showers, which fell on the 10th and 29th respectively, amounted to only .32 and .30 inch. The February fall was all concentrated during the first eleven days of the month, and after that no other rain fell in sufficiently heavy showers to penetrate to any depth.

The total precipitation for the season 1920-21 amounted to 26.71 inches, against 17.44 inches during the year now under discussion, and this shortfall is eloquently reflected in the decreased yields of nearly all crops. The average maize yield for the farm this year is 5.36 bags per acre, as against 11 bags per acre in the previous season, a decrease of rather over one-half. As has been stated in previous reports, the rotation experiments—each plot three acres in extent—are regarded as the most important crop investigation work on the farm, and it is satisfactory to observe the manner in which the various treatments are maintaining fertility, and how, if this year's report is compared with that of 1920-21, published in the issue of this journal for December, 1921, the relative yields of each plot, allowing for differences in rainfall, coincide.

The total area of land under crop was just over 500 acres, of which 217 acres were planted to maize for grain and 35 to maize for silage. About 40 acres out of the total were ploughed and either laid down to pasture or prepared for pastures next season.

As on the Salisbury Experiment Station, so in the case of the Gwebi Experiment Farm the object has always been, since the inception of experimental work, not to produce bumper crops, but rather to demonstrate how, under Rhodesian conditions, soil exhaustion can be avoided by means of rotation of crop, aided only by small amounts of farmyard manure and purchased artificial fertilisers. If production regardless of

expense were the object, yields could be very much higher. The total amount of manure and fertilisers used on the farm for raising the crops here reported on was 150 tons of farmyard manure and 3 tons of artificials, the latter costing approximately £16 per ton delivered on the farm. During the previous year approximately 100 tons of farmyard manure and 2½ tons of artificials were applied.

In the rotation experiments it will be seen that the use of manures and fertilisers is kept down to a minimum, and one which should be well within the reach of every practical farmer. Many of the rotations are not intended to be ideal ones. If after a series of years they prove unequal to maintaining fertility (as several will certainly do), they can be amended or their treatment rendered more liberal; and in the same way, where a farmer is following a somewhat similar rotation, he can, if able, introduce legumes or apply manure or fertilisers more frequently.

Unfortunately during the years of the war fertilisers were hard to come by, and their reliability, judging by results, left much to be desired; occasionally too certain seeds were unobtainable, and farmyard manure was not so plentiful on the farm as it is now. For these reasons the plots laid down in 1915 have not in all cases received the uniform treatment originally intended, nor has their fertility been so well maintained as would have been the case with more reliable artificials. The exact treatment is, however, given in respect of each plot.

In spite of this drawback and also of the fact that the full effect of the rotations commenced in 1919 is not yet observable, the average maize yield of all the rotation plots on land which has been under *continuous crop for an average of nine years* is even in this most unfavourable season 6.3 bags per acre, or precisely the same as that obtained from the 50 acres of even better land which has only carried three consecutive crops of maize. The yield of the *control* plot of maize in the rotation series, which has now grown maize every year for nine years and during that period has once been dressed with farmyard manure and once with artificials, was only 4.2 bags per acre, as against an average of over 7 bags per acre for the more successful of the older rotations.

If the adverse effect of the season is taken at having reduced the crop by one-half, it will be seen that in a normal season plot No. 18 would have yielded about 19 bags and many of the other plots over 14 bags of grain per acre. This may be regarded as a very satisfactory return from soil of the fertility of that of the Gwebi Farm, with so limited a use of dung and artificials and with all crops annually removed from the land.

Comparing some of the yields of this season with those of the previous year, it will be seen that in rotation No. 9—maize in the four-course, consisting of maize, velvet beans, oats, mangel—the maize yield in 1921 was 13.83 bags per acre, against 7.02 bags per acre (on plot No. 15) this year.

In course No. 10, plot No. 19 gave in 1921 the heaviest yield but one of any maize plot in the rotations, viz., 15.25 bags per acre. This season it stands first with a yield of 9.5 bags per acre. The continuous

maize plot, which this year yielded 4.2 bags, last year gave 8.08 bags per acre, while in the six-course rotation the maize yields were:—

	1921.	1922.
Maize after oats	5.4 bags per acre (very thin stand)	6.77 bags per acre
Maize after majortas ...	15.28 bags per acre	7.02 „ „ „
Maize after velvet beans	8.83 „ „ „	7.87 „ „ „

It is observable that as a general rule the heaviest yields of maize have been obtained after a previous crop of velvet beans, and this again confirms the value of this crop as a soil renovator. Owing to the scanty rainfall, the application of artificials has not been of as much benefit as usual, the fertilisers forcing on the growth and often inducing the plants either to tassel prematurely before the silks were receptive, or the whole plant to flower during the long and excessively hot drought of January. This in both instances led to a large percentage of barren ears.

Considering the rainfall, the failure of the mangel crops is not remarkable. Mangels figure in three of the rotations, firstly because they are regarded as a most exhausting crop to produce and secondly in order to provide these roots for stock feed. This year they received a top dressing of 50 lbs. nitrate of soda per acre with a view to repairing the injury caused by the January drought. Owing to lack of subsequent rain, the treatment had little effect. The dressing of manure applied to these crops is of course very light as compared with that usually given to mangels in other countries, but in view of the ease with which other succulents can be grown, it is doubtful whether, with our uncertain rainfall and the heavy demands of the crop on the soil, the ordinary farmer should attempt to raise mangels as a rainy season crop. If maize took the place of mangels in these rotations and received the same dressing of manure, both maize yields would certainly be considerably higher.

A point worthy of attention is the great immunity of the velvet bean to drought, the yields of hay and grain this year being practically the same as those in the more favourable season of 1921. The majorta yields certainly demonstrate the wonderful drought-resisting character of this crop and also its response to manure. The fact that for the first season on record all Kherson oats sown were reaped for grain and a total of over 6,000 lbs. weight of seed harvested points to the advisability of greater attention being accorded this crop in the dryer climate of Matabeleland.

CROP YIELDS IN ROTATION EXPERIMENTS.

Note.—Where a crop receives farmyard manure, the standard dressing since 1919 has been 8 tons per acre. Previous to this date the rate of application was 7 tons per acre. A dressing of artificials represents 150 lbs. per acre of complete fertiliser.

1. *Maize in a seven-course*, viz. : sweet potatoes, linseed, velvet beans, majorta, ground nuts, Sudan grass, maize.

Plot A.—The land has been under crop since 1912, and has never received manure or artificials. Yield—maize, 6.04 bags per

2. *Maize in a three-course, viz. : maize with artificials, majorta with dung, maize.*

Plot 1.—Received dung 1919, fertilisers 1915, 1918 and 1921.
Yield—maize with artificials, 6.45 bags per acre.

Plot 2.—Received dung 1920, fertilisers 1915 and 1916. Yield—maize following majorta, 5.32 bags per acre.

Plot 3.—Received dung 1915 and 1921, fertiliser 1917 and 1920.
Yield—majorta, 10.5 tons per acre.

3. *Maize in a three-course, viz. : velvet beans reaped for hay, mangel with dung, maize with artificials.*

Plot 4.—Received dung 1917 and 1920, fertiliser 1921. Yield—maize with artificials, 6.53 bags per acre.

Plot 5.—Received dung 1918 and 1921, fertiliser 1916. Yield—mangel with dung, 1.33 tons per acre.

Plot 6.—Received dung 1919, fertiliser 1915, 1917 and 1920.
Yield—velvet bean hay, 1½ tons per acre.

4. *Maize continuous since 1913.*

Plot B.—Received dung 1917, fertiliser 1915. Yield—maize, 4.2 bags per acre.

5. *Maize in a six-course, viz. : maize, velvet beans for hay, maize, majorta with dung, maize, oats. (From 1922 onwards maize following beans always receives artificials.)*

Plot 7.—Received dung 1917, fertilisers 1915 and 1918. Yield—oats, 237 lbs. grain per acre.

Plot 8.—Received dung 1918, fertilisers 1915, 1916, 1919. Yield—maize after velvet beans, 7.87 bags per acre.

Plot 9.—Received dung 1919, fertiliser 1917. Yield—velvet bean hay, 1½ tons per acre.

Plot 10.—Received fertilisers in 1915, 1918 and 1921, but by an oversight the majortas in 1920 failed to receive dung. Yield—maize with artificials, 7.02 bags per acre.

Plot 11.—Received dung 1915 and 1921, fertiliser 1916 and 1919.
Yield—majortas with dung, 15 tons per acre.

Plot 12.—Received dung 1916, fertiliser 1915, 1917 and 1920.
Yield—maize after oats, 6.77 bags per acre.

6. *Maize in a two-course.—Maize alternates with any bean crop except velvet beans or cowpeas.*

Plot C.—Received dung 1919, fertiliser 1917. Yield—maize after Tepary bean, 7.6 bags per acre.

7. *Maize in a two-course.—Maize alternates with velvet beans.*

Plot D.—Has only received dung in 1917. Yield—maize after velvet beans, 7.67 bags per acre.

8. *Maize in a four-course, viz. : maize, velvet beans for hay, oats, mangels with dung.*

Plot 13.—Received fertiliser 1915 and dung 1918. Yield—oats after velvet beans, 311 lbs. grain per acre.

Plot 14.—Received dung 1917 and 1921. Yield—mangels with dung, 2.31 tons per acre.

Plot 15.—Received fertiliser 1915 and 1917, dung 1916 and 1920. Yield—maize after mangels, 7.02 bags per acre.

Plot 16.—Received fertiliser 1916 and 1920, dung 1915 and 1919. Yield—velvet bean hay, $1\frac{1}{4}$ tons per acre.

9. *Maize in a four-course*, viz.: mangels with dung, oats, velvet beans for hay, maize. (Maize always with artificials except in 1919.)

Plot 17.—Received dung 1915 and 1919, artificials 1915 and 1918. Yield—velvet bean hay, $1\frac{1}{4}$ tons per acre.

Plot 18.—Received dung 1918, fertilisers 1915, 1917 and 1921. Yield—maize fertilised, 9.5 bags per acre.

Plot 19.—Received dung 1917 and 1921, artificials 1916 and 1920. Yield—mangels with dung, 4.25 tons per acre.

Plot 20.—Received dung 1916 and 1920, fertiliser 1915. Yield—oats, 211 lbs. grain per acre.

SERIES OF ROTATIONS COMMENCED 1919-20.

10. *Maize in a four-course*, viz.: Maize, maize with artificials, maize, velvet beans ploughed under.

Plot 21.—Received fertiliser 1920. Yield—maize after maize fertilised, 6.05 bags per acre.

Plot 22.—Received fertiliser 1919. In 1921 velvet beans were ploughed in.

Plot 23.—Has received no fertiliser. Yield, after velvet beans ploughed in, 7.77 bags per acre.

Plot 24.—Received fertiliser 1921. Yield—maize, 7.32 bags per acre.

11. *Maize in a four-course*, viz.: maize, maize with artificials, maize, sweet potatoes. (Commencing 1921, the maize following sweet potatoes receives dung.)

Plot 25.—Yield—maize with dung, 6.79 bags per acre.

Plot 26.—Received fertilisers 1919. Yield—sweet potatoes, 3.4 tons per acre.

Plot 27.—Yield of maize fertilised following sweet potatoes, 7.20 bags per acre.

Plot 28.—In 1920 land could not be cleared of sweet potatoes in time for ploughing, and this crop was left in for two seasons. Yield—maize after two years sweet potatoes, 5.70 bags per acre.

12. *Maize in a five-course*, viz.: maize, maize with artificials, maize, velvet beans for seed (vines ploughed under), oats.

Plot 29.—Received fertiliser 1920. Yield—maize after maize fertilised, 4.93 bags per acre.

Plot 30.—Received fertiliser 1919. Yield—velvet bean seed, 404 lbs.

Plot 31.—Yield—oats after velvet beans, 191 lbs. grain per acre.

Plot 32.—Yield—maize after oats following velvet beans, 6.55 bags per acre.

Plot 33.—Yield—maize fertilised after maize following oats, 7.36 bags per acre.

13. *Maize in a five-course*, viz. : maize, maize with artificials, maize, maize, velvet beans ploughed under.

Plot 34.—Yield—maize after maize fertilised following maize, 5.34 bags per acre.

Plot 35.—Yield—maize after maize following maize fertilised, 5.13 bags per acre.

Plot 36.—Yield—velvet beans after two crops maize; velvet beans ploughed under.

Plot 37.—Yield—maize after velvet beans ploughed under following maize, 5.50 bags per acre.

Plot 38.—Yield—maize fertilised after maize following velvet beans ploughed under, 6.37 bags per acre.

YIELDS OF MAIZE OTHER THAN IN ROTATION EXPERIMENTS.

	Acreage.	Yield per acre.	Total crop harvested.
Salisbury White; third-year land; third successive crop of maize	50 acres	6.3 bags	314 bags
Salisbury White; new land once ploughed	20 acres	2.98 bags	59½ bags
Hickory King; new land, part once, part twice ploughed	50 acres	4.66 bags	233 bags
Potchefstroom Pearl; very poor land; in part fertilised ...	14 acres	3 bags	42 bags

SUMMARY OF YIELDS OF CROPS OTHER THAN MAIZE GROWN FOR SEED AND NOT FIGURING IN THE ROTATIONS.

Crop.	Acreage.	Yield per acre.	Total crop harvested.
Black-eyed Susan pea	10	250 lbs.	2,500 lbs.
Red manna seed	1	335 lbs.	335 lbs.
Red manna seed*	6½	116 lbs.	753 lbs.
Boer manna seed	5	300 lbs.	1,500 lbs.
Buckwheat*	5	85 lbs.	425 lbs.
Ground nuts	25½	718 lbs.	18,312 lbs.
Linseed	8½	175 lbs.	1,459 lbs.
Kherson oats	11	323 lbs.	3,555 lbs.
Sudan grass seed	3½	167 lbs.	628 lbs.
Sunflower	10	762 lbs.	7,620 lbs.
Sunflower*	7	224 lbs.	1,568 lbs.
Sunn hemp	10	281 lbs.	2,810 lbs.
Tepary beans	8½	222 lbs.	1,847 lbs.
White velvet beans*	8½	213 lbs.	1,775 lbs.
White velvet beans	10	403 lbs.	4,030 lbs.
Florida velvet beans	14	300 lbs.	4,200 lbs.

YIELDS OF SUCCULENTS AND ROOT CROPS.

Crop.	Acreage.	Yield per acre.	Total crop harvested.
Majortas*	6 acres; unmanured	8.75 tons	52½ tons
Majortas	3 acres; manured in rotation experiments	10.50 tons	31½ tons
Majortas	3 acres; manured in rotation experiments	15 tons	45 tons
Mangels... ..	3 acres; manured in rotation experiments	1½ tons	4 tons
Mangels... ..	3 acres; manured in rotation experiments	2½ tons	7 1-10 tons
Mangels... ..	3 acres; manured in rotation experiments	4½ tons	13½ tons
Pumpkins	6 acres; land manured for potatoes previous year	3 1-6 tons	19 tons
Sweet potatoes...	3 acres; in rotation, but not manured	3 2-5 tons	10½ tons

YIELDS OF CROPS GROWN FOR FODDER.

Crop.	Acreage.	Yield per acre.	Total crop harvested.
Red manna hay	3 acres	1,315 lbs.	3,946 lbs.
Boer manna hay*	3½ acres	498 lbs.	1,661 lbs.
Boer manna hay	6 acres	1,451 lbs.	7,254 lbs.
Ground nut hay	25½ acres	463 lbs.	11,800 lbs.
Sudan grass hay	7¼ acres	738 lbs. } 897 lbs. }	11,850 lbs. (Two cuttings of hay taken.)
Oat straw	23 acres		10 tons
Veld hay			200 tons

PASTURE GRASS EXPERIMENTS.

The season was most adverse for the establishment of new pasture. On Redlands small acreages of molasses, Kikuyu, tussock, star and buffalo grass were successfully laid down from rooted plants. Sowings of Kudzu vine, Rhodes grass and Buffel grass failed, however, to germinate. The area under Kudzu was increased by means of rooted plants. On heavy black soil adjoining the Gwebi River small plots of swamp couch grass, Kikuyu, Penhalonga grass, *Paspalum dilatatum* and *P. scrobiculatum* have been moderately well established. Sowings of Rhodes, Buffel, *Paspalum virgatum* and *Phalaris bulbosa* failed on this soil also.

FEEDING TRIAL WITH SUNN HEMP SEED.

For this experiment an old trek bullock originally in poor condition, but which had been fattening for ten weeks, was chosen. The

* The crops thus indicated were grown on the extremely poor soil of Redlands and War Block, where yields are invariably very low. These fields are gradually being laid down to pasturage.

feeding trial commenced on the 17th June, and the ration of crushed Sunn hemp seed ($\frac{1}{2}$ lb. per day) was mixed with the other food that the bullock had previously been receiving, namely, a mixture of finely crushed maize, sunflower waste and bean waste. The Sunn hemp meal had a very disagreeable flavour and the bullock ate little or nothing of its new diet for the first week. During the second week the ration was changed and a quarter of a pound of Sunn hemp meal was mixed with dry maize meal, the sunflower and bean waste being discontinued. Still, however, the animal ate very little of this feed and subsisted chiefly on hay. During the third week, however, he began to eat up the ration freely, and the amount of Sunn hemp was gradually increased until the last week, when the bullock was taking it at the rate of $2\frac{1}{2}$ lbs. per day mixed with the maize meal, sunflower and bean waste originally given. In the three weeks from 3rd July to 23rd July the animal consumed 40 lbs. weight of Sunn hemp seed, or an average of just under 2 lbs. per day. Throughout the period the bullock never showed any ill effects from the diet, and increased in live weight from 860 lbs. to 940 lbs.

The late Mr. C. A. Dimmock reported (see *Rhodesia Agricultural Journal*, December, 1920) that cattle would freely graze over land which had grown Sunn hemp, and would pick up and eat without injurious effect all the dry leaves and fallen pods of the crop. Experience on the farm during the past season has fully confirmed this report. Cattle grazing over the old lands have entirely cleared up all fallen Sunn hemp leaves, pods and seeds.

Records of all experiments herein referred to have been most carefully kept by the farm manager, Mr. J. H. Hampton, and by Mr. R. C. Cardwell, and this report is framed on the data supplied by them.

Insect Pests of Fruits other than Citrus in Southern Rhodesia.

(Continued.)

By RUPERT W. JACK, F.E.S., Chief Entomologist.

INSECTS WHICH "STING" FRUIT (continued).

Fruit Flies (*Trypanidae*), Plate VII.—The cause of "stinging" with such fruit as peaches, plums, apricots, etc., is generally either fruit-piercing moths, which have been dealt with in the preceding pages, or *Fruit Flies*. The latter insects are exceedingly destructive in the Union of South Africa, but so far have not been convicted of much damage on the high veld of Southern Rhodesia. They seem to be rather more prevalent near the eastern border of the Territory in such localities as Umtali and Melsetter, but the position in these areas has not been closely examined.

The fruit flies, unlike the fruit-piercing moths, are intimately connected in their life economy with the fruit they injure. The females are provided with egg-laying instruments, known as ovipositors, with which they pierce the skin of the fruit and insert their eggs. These hatch into small maggots, which live in the pulp until they have attained full growth. The fruit by this time has usually fallen from the tree. The full-grown maggots then leave the fruit and enter the soil, where they pupate, the adult flies emerging later to recommence the life cycle.

The common fruit fly of the Cape, namely, the Mediterranean Fruit Fly (*Ceratitis capitata*, Wied), an introduced species, has been studied closely by Mr. C. W. Mally, now Senior Entomologist for the Cape Province. The male of this species is figured on Plate VII. Mr. Mally records the following details of the life history. The eggs in summer hatch in from two to four days. The ripeness of the fruit seems to have an influence on the time required for hatching, and if the fruit is too green the eggs may not hatch, or if they do, the young maggots perish immediately. The larval or maggot stage usually occupies from a fortnight to three weeks and the pupal stage in the soil from twelve days to three weeks, dependent on the season. The whole cycle at mid-summer may occupy as little as twenty-eight days, and as much as two months or more during the winter (at Grahams-town). The females survive several months during the winter if no fruit is available for oviposition.

The following food plants are recorded for this species at the Cape:—Peach, plum, apricot, nectarine, apple, pear, quince, orange,

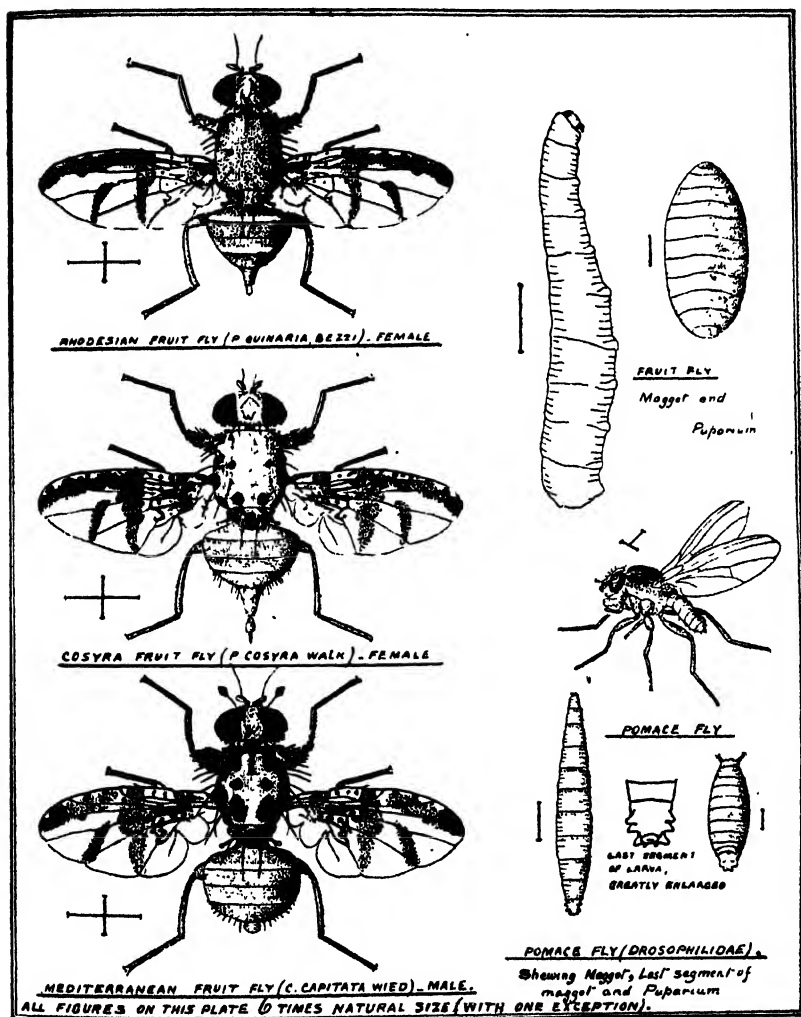


Plate VII. Insect pests of fruit.

lemon, pompelmous, *Citrus buxifolius*, loquat, guava, prickly pear, Kei apple (*Aberia caffra*), kaffir plum (*Harpephyllum caffrum*), passion flower (*Passiflora carulea*) and *Solanum capsicastrum*.

The Mediterranean Fruit Fly is not the only species attacking the common cultivated soft fruits in Southern Rhodesia. Two other species at least are involved; the one, which is referred to as the Rhodesian Fruit Fly (*Pardalaspis quinaria*, Bezzi), proving new to science when specimens were forwarded to England, and the other, *Pardalaspis cosyra*, Walk., being also a common species in Natal. Both the latter species are presumably native to South Africa. A female of each is figured on Plate VII. The Rhodesian Fruit Fly has been bred from fig, apricot and peach at Salisbury. The Cosyra Fruit Fly has been bred from orange, guava, "mahash" (*Parinarium mobola*), marula plum (*Sclerocarya caffra*) and an unknown native fruit from the districts of Salisbury, Marandellas, Lomagundi and Umtali. The Mediterranean Fruit Fly is recorded from Salisbury, Lomagundi and Umtali feeding in apricot, orange and guava. The great majority of the specimens in the collection were bred from the last-named fruit.

The reason for the comparative unimportance of the fruit flies in this Territory is not clear, but the writer is inclined to attribute it to the lateness of the rains compared with most parts of the South African Union. In this connection it is noteworthy that Mr. Claude Fuller, when Government Entomologist in Natal, discussing the great and unusual scarcity of fruit fly in the early part of 1905 (Natal *Agricultural Journal*, 24th February, 1905), ascribes the fact to the "unusually dry spring." If this is the reason there is no such check at work in the Melssetter district during normal years, and the flies might be expected to be prevalent there. Unfortunately, owing to the common confusion between the work of fruit-piercing moths and that of fruit flies, reports as to prevalence in that isolated district are not altogether reliable. It may be mentioned here that hymenopterous parasites have been bred from *Pardalaspis cosyra* at Salisbury.

To Distinguish Between Injury by Fruit-Piercing Moths and Fruit Fly.—This is a matter which really presents little difficulty. In the case of fruit fly attack it is the presence of the maggots which causes the damage, and these may be sought in the decayed pulp. In the case of fallen fruit they may, of course, have left, but in general, examination of the crop on the trees will speedily decide the question of the cause of the injury. Fruit moths also make quite a definite pin hole in the skin of the fruit, which is unmistakable once one has become familiar with the appearance of fruit "stung" by these insects. A lantern taken into the orchard after dark will also reveal the moths at work.

The only source of confusion between the two lies in old fruit which may have become infested with the maggots of Pomace Flies (*Drosophilida*) subsequent to fruit-piercing moth injury. These maggots are liable to be mistaken for those of the fruit flies. They may, however, be distinguished by the fact that the fruit fly maggots are blunt at the hind (larger) end, whereas the maggots of the Pomace Flies show a number of projections at this part (see Plate VII.). The figures on Plate VII. are all drawn to the same scale, with the excep-

tion of the much enlarged figure of the last segment of the Pomace Fly maggot, and it will be seen that the Pomace Fly in all stages is very much smaller than the fruit flies, so that the only real difficulty lies in distinguishing between nearly full grown Pomace Fly maggots and very young fruit fly maggots. The disparity in size between the puparia (chrysalis stage) is a sufficient distinction apart from the projections which adorn the Pomace Fly puparium.

Fruit Fly Control.—Thanks to the researches of Mr. C. W. Mally at the Cape, control of fruit fly is now on a well established basis. The method employed is to poison the female flies between the time of their emergence from the puparium and the time they would commence to lay eggs. To effect this it is necessary to apply a poisoned bait regularly to the trees in such a way as to give it the maximum chance of being found by the flies. The bait is applied by means of an ordinary garden syringe, the liquid being squirted up so as to fall in a shower on the foliage. In this way the majority of leaves are spotted with the bait, and the flies haunting the trees are nearly sure to find some of it to feed upon. The bait is applied lightly, one syringe-ful for a well grown peach tree, and must of course be renewed after rain, and in any case after 10 days. It should be noted that it is of little use commencing to distribute bait after the crop has become badly infested. It is obvious that, if egg-laying is to be prevented, operations must commence early on all the varieties of trees subject to infestation, otherwise increase of flies is liable to occur by the time the later fruits near the ripening stage. Three weeks before the earliest apricots ripen is the time recommended in the South African Union for the commencement of operations, and the baiting should be continued till three weeks after the latest fruits are off the trees. Other trees which serve as hosts for the flies during the winter, such as guavas, oranges, etc., should also be baited in their season to help reduce the numbers of the pest, and, to guard against flies entering the orchard from outside, some of the surrounding trees and bushes may also be treated. The formula for the bait is as follows:—

Arsenate of lead (paste), 3 ozs.
or Arsenate of lead (powder), 1½ ozs.
Crude treacle, ½ gall.
or Cheapest sugar, 2½ lbs.
Water, 4 galls.

Make up fresh when required and stir when using.

Netting the trees is, as already mentioned, sometimes practised against fruit fly. A light cotton netting of ten meshes to the inch has proved a sufficient protection, and in view of the far greater risk of damage by fruit-piercing moths than by fruit fly in this Territory, the netting method, which serves as a protection against both classes of pests, has much to recommend it.

Regular collection and destruction of fallen fruit in the orchard is also beneficial.

Citrus or False Codling Moth (*Argyroplote leucotreta*, Mevr.), Plate VIII.—Although this insect has not been recorded in Southern

Rhodesia as a pest of cultivated fruits other than citrus, guava and pomegranate, the scope of the title to this article renders a short account necessary for the sake of completeness.

It would be difficult to say whether the guava or pomegranate is the more preferred by the insect. Both fruits are frequently very heavily infested, the infestation approximating a hundred per cent. on some trees in certain seasons. Owing to this fact, these fruits are bad neighbours to citrus trees, as they tend to encourage increase of the pest.

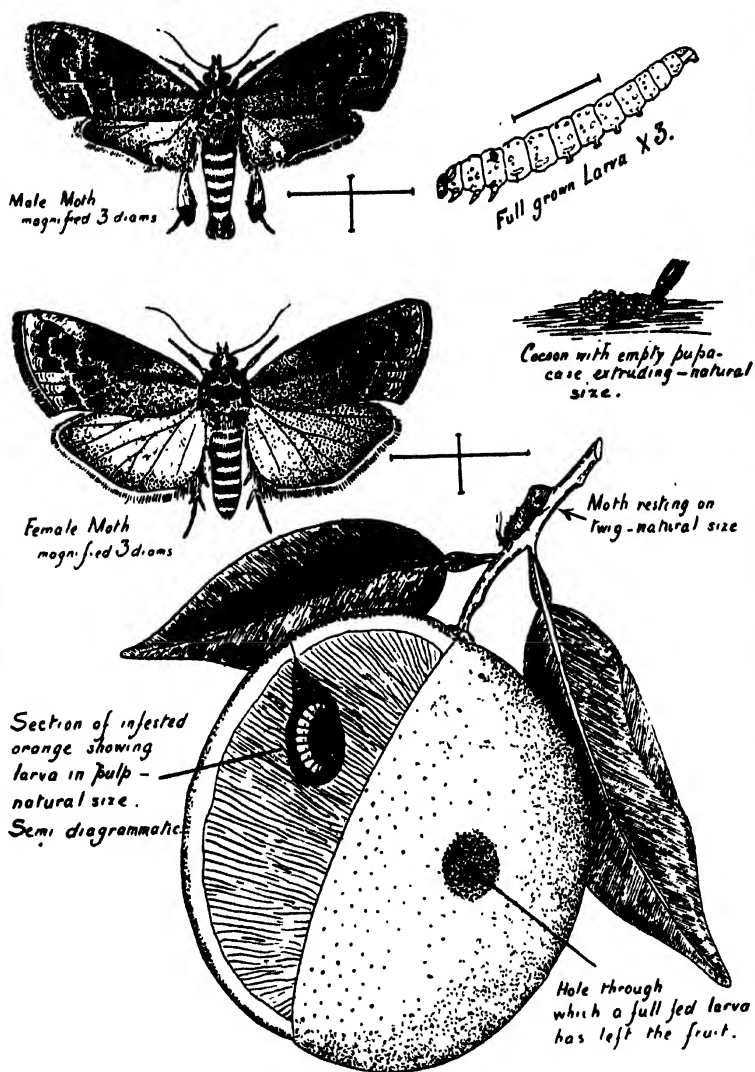
The life history of this insect has not been worked out in this Territory, but Mr. David Gunn, of the Union Division of Entomology, has published a very full account.[†] The eggs, which are very small, flat, whitish objects, less than one twenty-fifth of an inch in diameter, are laid on the skin of the fruit or the neighbouring foliage. They hatch in from 9 to 14 days. The young larva after hatching eats its way into the pulp of the fruit, where it remains until it has attained full growth. The period occupied by growth in the fruit apparently varies considerably, according to the species of fruit and its degree of ripeness. In guavas in the month of February, March or April the duration of this period is given as varying from fifty-nine to seventy-one days. On attaining full growth the larva leaves the fruit and spins up in a cocoon on the surface of the soil, where in the winter it apparently rests between three or four weeks before pupating. After this event a further period of several weeks, varying with the time of the year, elapses before the moth emerges. The total length of time from the day the eggs were deposited to the day the moths emerged in twenty specimens bred in guavas varied from 143 to 167 days. Mr. Gunn is of opinion that three completed broods may mature during a year, but different fruits are, of course, necessary for each brood.

In Southern Rhodesia the moths from guavas and pomegranates emerge chiefly in June and July, but from various fruits that have been bred out throughout the year.

The recorded host plants for the citrus codling in South Africa (including Southern Rhodesia) are as follows:—(1) *Cultivated*.—Citrus, Guava, Pomegranate, Oak (Acorns), Walnut, Plum (especially the Satsuma), Apricot, Peach, Olive, Persimmon. (2) *Native Plants*.—Marula Plum (*Sclerocarya caffra*),* *Zizyphus mucronatus*,* Zuurpruim (*Ximenia caffra*),* Wild Mispel (*Vangueria infausta*),* Rooibosch (*Combretum Zeyheri** and *C. apiculatum**), Blauwbosch (*Royena pallens*),* Yellow-wood (*Podocarpus falcata*), Stamvruchte (*Chrysophyllum magalis—montanum*), Hottentot Bean (*Schotia speciosa*). The above list, which is mainly taken from Mr. Gunn's paper, already cited, is probably by no means complete. The only food plant so far ascertained in Southern Rhodesia which is not recorded from the South African Union is *Zizyphus mucronatus*, but it appears probable

[†] "The False Codling Moth," *Science Bulletin* No. 21, Department of Agriculture, S.A. Union, 1921.

* Recorded by Evles from Southern Rhodesia. Other species of the genera *Chrysophyllum* and *Schotia* are recorded, but not the two mentioned by Gunn.

CITRUS CODLING MOTH

that an insect having so wide a range of food plants will eventually be found in others of our native fruits. It is to be noted that the moth has not yet been bred from the common Mahash or Mobola (*Parinarium mobola*), Mahobohobo (*Uapaca kirkiana*) or from Wild Figs.

Control.—This insect is, of course, chiefly of importance as a pest of citrus fruits. The two other cultivated fruits, namely, guava and pomegranate, which are heavily attacked in the Territory, are hardly of sufficient importance to stimulate the grower to adopt much in the way of control measures, except perhaps on farms remote from the railway, where fruit of any sort is difficult to procure. It by no means follows, of course, because attack on apricots, peaches and plums has not been recorded by the entomological staff, that these fruits are not attacked in the Territory. Such attack would in most cases be attributed by the grower to fruit flies, which are commonly held responsible for all forms of fruit "stinging." The caterpillar of the citrus codling can, of course, easily be distinguished from fruit fly maggots on account of the presence of legs, all fly maggots being legless.

Control methods which seem to give excellent results in the case of citrus orchards consist in (1) eliminating other host plants of the pest from the neighbourhood of the orchard, and (2) collecting and destroying "stung" fruit as a regular practice. Experience at Salisbury indicates that out-of-season fruits, such as oranges and guavas, are very liable to heavy infestation in the spring, and are thus undoubtedly of considerable value in tiding the insect over a period of relative scarcity in regard to the fruits, wild and cultivated, in which it breeds. If the pest is allowed to breed unchecked in such fruits, a big brood of the moths may be expected to appear early in the growing season, with consequent danger of much damage to fruits from November onwards. The fact that practically the whole crop of oranges and naartjes on certain farms has on occasion been ruined by this pest shows that, under conditions of neglect, it may develop into a really bad pest, whereas in carefully tended plantations serious loss has not yet been reported. The moral for the farmer who looks to his own farm to produce an abundance of fruit at least for home consumption is that (1) no fallen fruit of any description should be allowed to remain on the ground, but should be collected regularly and either buried effectually in the ground or burned; the trouble and time consumed in regular inspection of the bearing trees and removal of stung fruit, which must, of course, be treated like fallen fruit, may also be worth while; particular attention should be paid to out-of-season fruit in the latter parts of the dry season; (2) wild fruit trees known to be hosts of the pest should be cut down in the neighbourhood of the cultivated fruit trees.

Trees properly netted against fruit-piercing moths and fruit flies would also, of course, be protected from the present pest.

Fig Weevil or Fruit Curculio (*Omophorus stomachosus*, Boh.),*
 Plate IX.—The term "weevil" is properly confined to representatives

* Better known to entomologists under the name of *Metatrypes turritus*, Pasc.

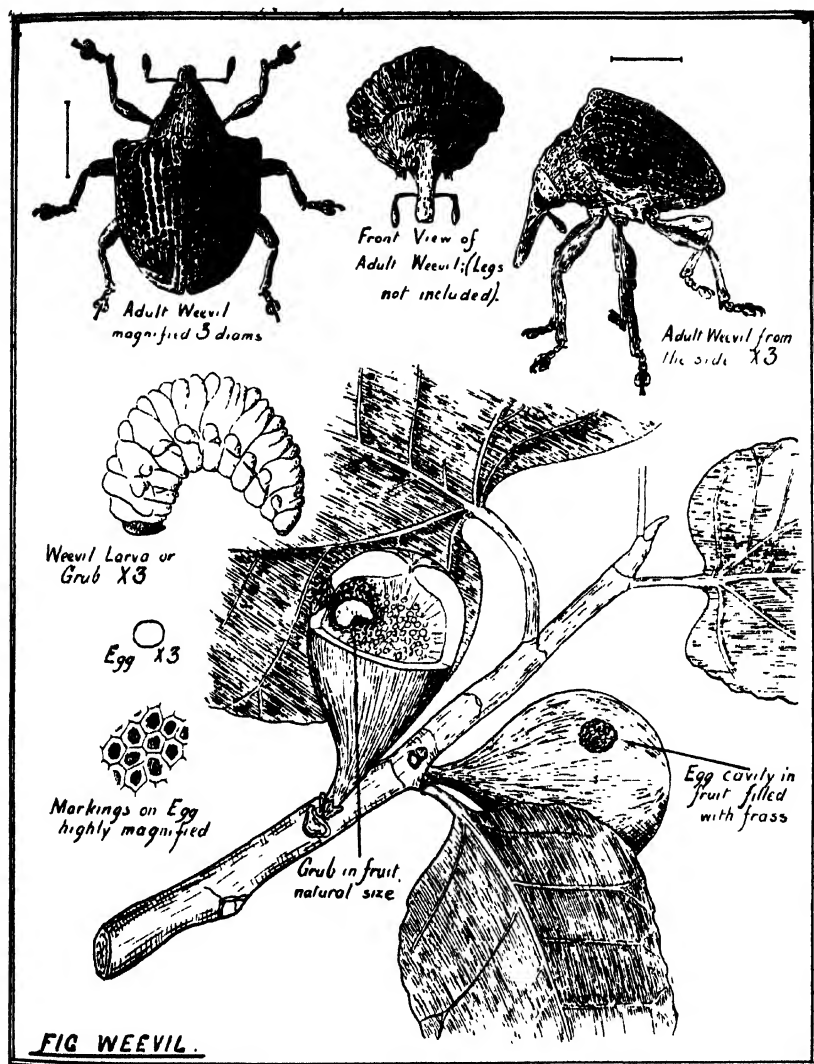


Plate IX. Insect pests of fruit.

of that family of beetles in which the head is prolonged into a distinct "snout." A glance at Plate IX. will convince the reader that this particular pest is a typical member of the family. The term "*Curculio*" is obtained from the Latin name of the family, namely, the *Curculionidae*, and is sometimes employed to distinguish these members which are of economic importance, but are not pests of stored products. The term "*weevil*" is of course best known in reference to the grain weevils (*Calandra* spp.), which are also members of the *Curculionid* family.

The fig weevil is a well known South African pest and probably the commonest cause of "stung" figs. The life history is as follows:—The female beetle eats a cavity in the skin of the fruit and inserts an egg, afterwards stopping up the hole with the material obtained in excavation. The egg measures about $1\frac{1}{2}$ mm. (about $1/17$ of an inch) in length and about $1\frac{1}{5}$ mm. (about $1/21$ of an inch) in breadth. The surface is seen under the microscope to be covered with an irregular network of shallow pits. Eggs are apparently mainly laid in fruits which are about half developed. This is by no means invariably the case. Very young grubs are quite common in practically fully developed fruit, and fruit may be attacked when quite small. In a general way, however, most of the stung fruit is about half developed. They hatch in about three days, and the growth of the grubs generally checks the further development of the fig. These grubs are white and, in common with other members of the family, destitute of legs. They attain full growth in a little short of three weeks and change to the pupæ or chrysalis stage within the fruit, which usually falls to the ground about this time. Some six days or so later the adult beetle appears, leaving a characteristic triangular hole in the wall of the fruit.

The number of broods throughout the year does not appear altogether clear. Fuller states* that in Natal the females hibernate, that is, remain more or less quiet without breeding during the winter months and become active again in the spring, and that the number of broods is confined to two. Observations in this Territory do not altogether bear out the foregoing statement. Fully developed wild figs collected in Salisbury on 7th July yielded adult weevils from 28th July to 28th August, indicating that at least a partial winter brood may occur. Very large numbers of beetles have been bred in October and November, constituting the main spring brood. Beetles have also been bred out freely enough in December and January, whilst one record indicates adults in the fruit in February. The immature stages, i.e., grubs and pupæ, have been recorded from October to February inclusive. It appears, therefore, probable that the insect continues breeding throughout the year where fruit is available, but that the grub stage is prolonged during the cold weather. In the hot weather the whole life period from egg to adult occupies less than a month, and, although there appears to be no record of the time which elapses between the appearance of the female beetle and the commencement of egg-laying, the indications are that four or five broods can

* Fourth Report of the Government Entomologist, Natal, 1903-1904, p. 13.

mature during the year. In any case the broods overlap very much as the season advances, so that all stages of the insect are sometimes to be found in the figs at the same time.

The insect breeds quite as freely in wild as in cultivated figs, but is not known to attack any other class of fruit. The adult beetles feed not only on the flesh of the fruit, but will also gnaw the young bark of the twigs in the absence of fruit.

Control.—As in the case of other insects which breed in fruit, the regular collection and destruction of infested fruits should be highly beneficial. The egg punctures on the fruit are large and conspicuous, so that collection is not a difficult matter. Furthermore, removal of wild fig trees, or at least systematic destruction of the fruit of such, in the vicinity of the cultivated trees is absolutely necessary. The fruit collected should, of course, be destroyed by fire or buried, and not just thrown on the rubbish heap. If the latter procedure is adopted, many of the beetles will breed out quite as happily as if the fruit had been left on the trees.

Finally the beetles have the habit when disturbed of "shamming dead" and falling to the ground. By carefully spreading a couple of white sheets beneath the trees, taking care not to shake the trees during the process, the beetles may be jarred from the trees in the early morning and, being conspicuous on the white background, are readily collected and destroyed. This process should be carried out regularly and systematically during the summer, and constitutes the main chance of checking the damage once the pest has put in an appearance.

It is possible that spraying with an arsenical compound, as now practised against the Plum *Currulio* in America, might be beneficial, but no definite method of spraying against the present pest has apparently as yet been elaborated.

Heavy spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water, in early September is perhaps worth a trial, and the addition of some 6 lbs. of cheap sugar or a gallon of molasses to each 10 gallons of liquid might add to the efficacy of the spray. The twigs on which the adult beetles tend to feed should, of course, receive special attention. In general, however, it appears desirable at present to rely upon control measures other than spraying, which is only mentioned for the benefit of those who may wish to experiment.

Fig Pyralid (*Polygrammodes hirtusalis*, Walk.), Plate X.—An insect which commonly infests a high percentage of the fruit of wild figs at Salisbury is the Pyralid Moth, *Polygrammodes hirtusalis*, but so far it has not been recorded from cultivated figs. It would appear, however, to be a potential pest of some significance and may have been confused with the fig weevil on occasion.

Little is known concerning the life history of this insect. It has been bred out in numbers in September and November, whilst one adult moth in the collection was taken in January. In late October of the present year the larvæ were present in large numbers.

The moth itself is yellow in colour, with the basal half of the forewings russet brown and some small spots of the same colour showing elsewhere on the yellow ground. The larva is easily distinguished from that of the fig weevil, not only by its colour, but also on account of the presence of a full set of legs. (See illustration.) The general appearance of the caterpillar is smooth, the colour greenish white, the dorsal portion of each segment being pigmented with rose pink or reddish brown. In addition each segment has a number of circular blackish tubercles, from the centre of each of which springs a rather long hair. The head and thoracic shield are dark sepia brown. The fully grown caterpillar measures about an inch in length. When fully grown it apparently leaves the fruit and spins a tough cocoon in some convenient crevice, within which it changes to the pupa stage, the adult moth emerging apparently within 2 or 3 weeks in the summer months.

Control.—Destruction of infested fruit and elimination of the wild figs in the vicinity are indicated. Owing to the fact that the adults cannot be destroyed as recommended in the case of the fig weevil, this pest would probably prove more difficult to check after infestation of the crop has commenced.

(To be continued.)

Farm Cheese-making.

By T. HAMILTON, M.A., N.D.A., N.D.D., Dairy Expert.

During 1921 there was imported into Rhodesia cheese to the value of £10,402. This money could well have been kept in the country, as every farmer should be able to make cheese for home use, and any surplus, if properly made, could easily be disposed of in the towns.

Cheese as an Article of Diet.—Cheese is a most concentrated food, one ounce of mature cheese being equivalent in food value to two ounces of prime beef. Cheese, moreover, possesses the great advantage of remaining in good condition over long periods without the aid of refrigeration. On outlying farms, where game is becoming scarcer every year and where meat from the butcher is received only once a week, cheese should enter more largely into the dietary than it does at present. It possesses nutritive properties and muscle-building materials in such proportions as to put it an easy first amongst human foodstuffs.

REQUIREMENTS FOR FARM CHEESE-MAKING.

The requirements for farm cheese-making are simple and few in number. These are—

- (a) An improvised vat.
- (b) A steel cheese mould.
- (c) Cheese rennet.
- (d) Cheese colour.
- (e) A dairy thermometer.
- (f) A measuring glass.
- (g) Four or five gallons of hot water.

Cheese Vat.—On most farms will be found a bath or dish capable of containing 10 to 12 gallons of milk. This bath should be placed inside another receptacle of slightly larger dimensions, so that the space between the two may form a "jacket" into which hot water can be poured. This makeshift arrangement is quite effective for home use.

If, however, cheese is to be made regularly, it is of course advisable to have a properly constructed jacketed vat made. The inner vessel should be made from tinned steel of at least 22 gauge, whilst the outer vessel should be made from strong galvanised iron sheets.

A Cheese Mould.—Another necessary article is a strong steel mould. It is best purchased, as home-made moulds are apt to burst under the

pressure to which they are subjected. This pressure, as is afterwards explained, may be as much as 30 cwts. A purchased cheese mould will last a lifetime, it being practically indestructible.

Cheese Rennet.—Only standard brands of this article should be purchased. The rennet should be fresh and up to strength. It should always be kept in a dark, cool place. If cheese is made only occasionally, small quantities should be purchased. Rennet quickly loses its strength if exposed to moderately high temperatures or strong daylight. Liquid rennet is to be preferred for cheese-making, although fairly good results are sometimes obtained by the use of rennet tabloids or powders.

Cheese Colour.—Only standard brands of this material also should be used. On no account should a farmer attempt to use butter colour for cheese-making. The two substances are different in character, the cheese colour being made up as a solution in water, whilst the butter colour is made up in oil.

A Dairy Thermometer.—This is essential if cheese-making is to be carried on successfully. Before purchasing a thermometer it is wise to test it against a standard thermometer. An error of a few degrees may cause a failure to be made of cheese-making.

Measuring Glass.—This is not an absolute necessity, but it is a great convenience. If no measuring glass can be obtained, the cheese-maker should remember that—

- 1 teaspoon=1 dram.
- 8 drams=1 fluid ounce.
- 20 fluid ounces=1 pint.

Hot Water.—Sufficient hot water for a small quantity of cheese can be obtained by using a couple of petrol tins as a boiler.

CONDITIONS FOR CHEESE-MAKING.

Cheese-making is most satisfactorily carried on during the cooler season of the year, or at an elevation (in Rhodesia) of from 5,000 to 6,000 feet above sea level. A cool curing-room is essential if cheese is to be stored over any lengthy period. The temperature of the room should as far as possible be kept below 70 degrees, and this can only be done by building an insulated room, shutting it up in the daytime, and opening it up at night.

MILK FOR CHEESE-MAKING.

The milk as far as possible should be fresh. This is generally feasible in this country, where the practice of milking only once a day on the farms is very prevalent. If overnight's milk is to be used for cheese-making, it should be specially cooled, either by putting it over a milk cooler through which cold water is constantly flowing, or by immersing the buckets containing the milk in a trough through which cold water is trickling. If this is done, the lids should be left off, and the cans covered with a piece of butter muslin tied round the top.

Even though these precautions are observed, sometimes the milk becomes sour during the night. Sour milk should not be used for cheese-making, but should either be separated or fed to the pigs. If the milk is slightly sour, great care should be taken not to raise the temperature for separation. Should the temperature be raised, there is a great danger that the milk will suddenly turn thick, when of course separation is impossible.

Size of Cheese.—For commercial purposes it is absolutely necessary to make cheese of the recognised trade sizes, which in South Africa are the 10 lb. cheese, the 20-30 lb. cheese and the 40 lb. cheese. These are made in moulds of 7 inch, 11 inch and 13 inch diameter respectively. There is a very limited commercial demand for the 10 lb. cheese, except for country hotels and for large households. It is, therefore, recommended that farmers, before taking up cheese-making on a commercial basis, should be assured of having a daily supply of from 25 gallons of milk upwards, so that the cheese manufactured may be of the size required by the merchants in the larger towns. It should perhaps be explained that a gallon of average milk makes about 14 ounces of mature cheese. To fill an 11 inch mould, the cheese-maker will therefore require from 25 to 30 gallons of milk.

Time Occupied in Cheese-making.—The process of cheese-making is carried on through well-marked stages. The time which elapses from the pouring of the milk into the vat until the cheese is placed in the mould and put into the press is generally about five hours.

THE PROCESS OF CHEESE-MAKING.

The first attention must be given to the scalding of the vat immediately before milk is placed in it. This is necessary even though it has been scalded some time previously. When this has been done, the milk must be carefully strained through two layers of scalded butter muslin. Should the milk contain particles of manure, dust, etc., it will rapidly deteriorate, and the souring that will then take place will result in inferior cheese which will "blow" or "leak" in the curing room.

The "Starter."—A "starter" must be used if fresh milk is to be made into cheese. If cheese is to be made on a large scale it is advisable to use a commercial starter, which can be obtained from dealers in dairy requisites. These starters, however, are expensive, and it will perhaps suffice if a home-made starter is developed in the following manner:—

Heat a quart or more of freshly separated milk in a double pan and maintain the milk at a temperature of 180 degrees for 20 minutes or more. Cool down the milk as rapidly as possible by stirring and by immersing the vessel containing it in cold water. Change the water as often as is necessary until the temperature is reduced to 75 degrees. Keep at this temperature, the vessel containing the milk being always placed in cold water, until in about two days the milk will be quite thick and smooth in appearance. The starter should, when stirred, have a clean acid smell, and show no signs of gassiness or fermentation.

When adding the starter to the milk, the top portion should be discarded. The rest should be well stirred with a spoon previously scalded and added to the milk approximately in the proportion of one and a half fluid ounces per gallon of milk (i.e., one pint and a half) to twenty gallons of milk. Starters vary in activity, so that the exact amount to add can only be gauged by the previous day's experience.

If cheese-making is to be continued from day to day, it will be necessary to propagate the starter day by day. To do this, heat one quart of either whole milk or separated milk (separated milk is best) as before, to a temperature of 180 degrees, and cool it down rapidly. Propagate the starter by adding a small portion of the soured milk to the milk already pasteurised.

When adding the starter to the milk in the vat, it is best to squeeze it through two thicknesses of scalded butter muslin.

Cover up the vat with a clean sheet or thin blanket and keep the milk at a temperature of 84 degrees for about 30 to 45 minutes.

Test for Acidity.—It is important to know exactly how ripe the milk is before adding the rennet. For this purpose the "rennet test" has been devised. The test is as follows:—

One dram of rennet is measured and placed in a cup together with some small pieces of burnt match. The latter acts as an indicator. The cup should be slightly warmed beforehand. Four ounces of the milk for rennetting, heated to 85 degrees, are then measured out and the time noted on the second hand of the watch. When the second hand of the watch reaches an even figure, such as 20, 30 or 45 seconds, the milk is poured rapidly on to the rennet (not *vice versa*). The milk is then stirred with a teaspoon for exactly 10 seconds, and the teaspoon is then withdrawn. When the milk begins to coagulate or curdle the pieces of burnt match stop moving, and the time (read on the second hand) must be taken at this point. The number of seconds which elapse from the time of pouring the milk on to the rennet to the time the pieces of burnt match cease revolving give the test. For a quick-ripening cheese, not so much acidity is required, and the time of the test varies from 24 to 28 seconds. If, however, cheese is meant to be stored, a good deal of acidity is developed and the time will then be from 18 to 22 seconds.

This test depends on the fact that the greater the amount of acidity in the milk the quicker it will coagulate with rennet. It is obvious, however, that the success of this test depends upon the rennet being up to standard strength. Old and weak rennet is useless for this test, and cheese-makers, if they still have old rennet, would be well advised to obtain a small quantity of fresh rennet exclusively for the rennet test.

Adding the Colour.—As soon as the milk is ready for rennetting, no time should be lost in adding cheese colour in the proportion of 1 dram colour to 10 gallons of milk. The colour must be mixed with at least ten times its bulk of water and well stirred in.

Adding the Rennet.—After the colour has been well mixed and the

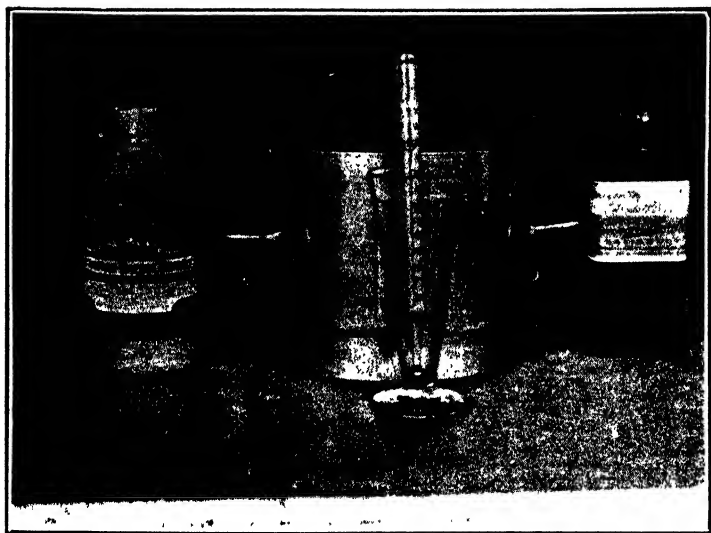


Fig. I. Essentials for farm cheese-making: (a) Rennet, (b) Colour, (c) Cheese mould, (d) Measuring glass.

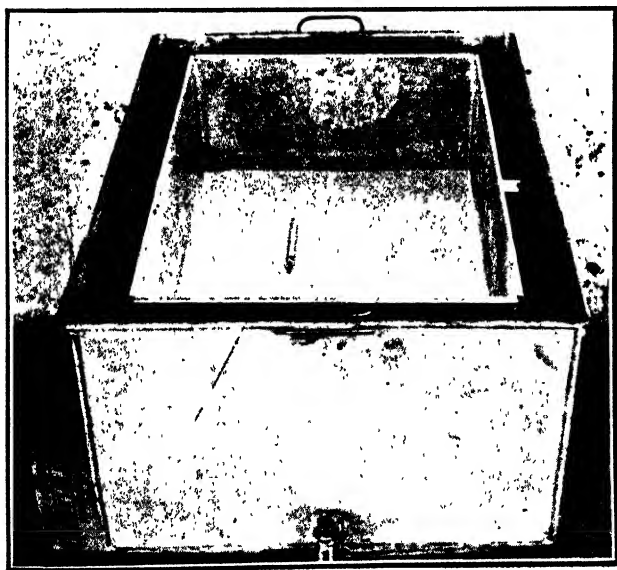


Fig. II. The milk in the vat. Any vessel or bath can be used.

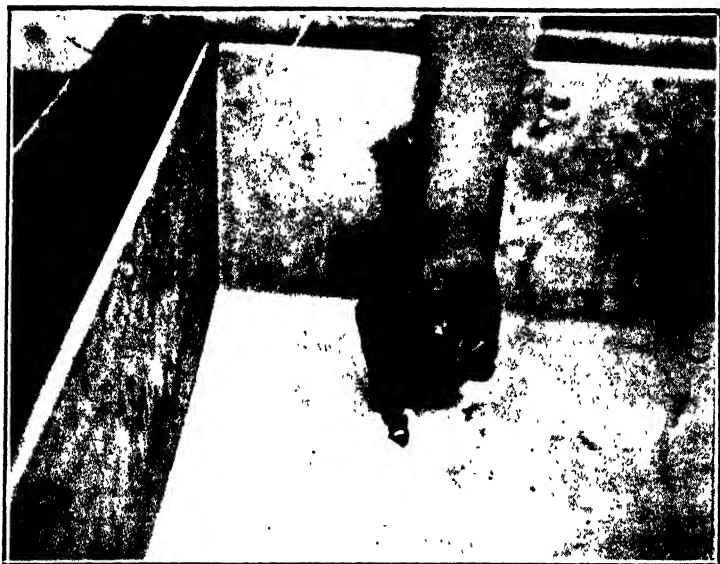


Fig. III. When the curd splits cleanly over the finger it should be cut in $\frac{1}{2}$ -inch cubes.



Fig. IV. Cutting the curd into $\frac{1}{2}$ -inch cubes with table knives tied together.

rennet test has been satisfactorily performed, rennet (*i.e.*, standard rennet) is added in the proportion of 1 dram of rennet to $2\frac{1}{2}$ gallons of milk. The rennet must be mixed with about ten times its own bulk of water and well stirred in for two minutes or more, according to the amount of milk in the vat. If the milk is very acid, be careful not to stir too long, otherwise a smooth, even coagulation will not be obtained. In about five minutes' time the milk should be lightly stirred on the surface with a thermometer, to mix down the cream which has in the meantime risen. Now cover the vat with a clean cloth and leave the curd to coagulate.

Odzi Canning Factory.

The liquidation of the Odzi Canning Co. will come as a blow to its many farmer shareholders, both on account of the financial loss involved and through the closing of an outlet which, though a small one, has yet undoubtedly been a great boon to many of our stock owners, particularly the smaller ones and those remote from access to the Rand markets or local mine compounds.

During its rather erratic life the Odzi Canning Factory has treated 8,885 head of cattle and has shown that good bully beef and valuable by-products in the form of fat, hides, horns and fertiliser could be produced without attempting the scores of other side lines into which a complete "packing house" can convert the whole ox.

An extraordinary general meeting of the shareholders of the Rhodesia Meat Packing Company was held in Salisbury on 21st November, when a resolution deciding to place the company in voluntary liquidation was passed *nem. con.* The main cause assigned for the failure of the first Rhodesian canning factory was the competition of Australian canners, who, with the assistance of a bounty from their Government, were able to under-cut prices in South Africa. The records of the Odzi Canning Factory are to be preserved for future guidance in the event of another attempt to start the industry being made in more propitious circumstances.

Tsetse Fly, Eastern Border.

By J. K. CHORLEY, Assistant Entomologist.

On account of the heavy mortality from trypanosomiasis amongst several herds of cattle along the eastern border, it was decided that a general survey of the conditions should be made and the problem studied from the purely entomological standpoint.

The investigations were divided into two main divisions, firstly the demarcation of the permanent fly belt and breeding places in Portuguese territory close to the border, and, secondly, an attempt to prove the presence or otherwise of tsetse within the Rhodesian border.

A commencement was made at Welgelegen, where the Haroni Valley was entered and followed down as far as possible, then along the ridge on Tilbury and Rumble Rills to the junction of the Haroni River. The country below the junction was carefully examined, and also above the junction as far as the M'sembala River, a small tributary of the Lusitu, this stream then being followed up to the watershed, and so over into the Puizeze Valley. I crossed into Rhodesian territory at Vermont, close to the headwaters of the Puizeze. Continuing down the border as far as Jersey, the Chinyika was followed into Portuguese territory to Chingourd's Kraal, and then south to Pandi's Kraal on the Umselezwe River, where four days were spent examining the country and searching for fly. From the Umselezwe River native tracks were followed to the Busi River, some fifteen miles below Spungabera, and from here to the Spungabera-Gogoi Road, about four miles from the Makonomi River, and along the road to Gogoi. Three days were spent in the vicinity of Gogoi examining the country under the Sitatonga Hills, after which the Chicambue was followed to its source on the border near East Leigh.

Most of this country had in previous years been badly infested with fly, and I had hoped to be able roughly to delimit the fly belt and do such work on the bionomics of the fly and its relation to certain types of forest country as was possible. Unfortunately this was impossible, as I totally failed to find any fly, except in the vicinity of Gogoi and east of Gogoi, where four specimens of *G. pallidipes* were captured. This was at least eighteen miles from the border. Even along the Spungabera-Gogoi Road, a well known haunt of tsetse, no fly were seen. On the Umselezwe River native goats were used as bait, and, though not possessing great attractive powers, it is hardly possible that if fly had been present I should have failed to see them.

After re-entering Rhodesian territory, all the border farms between East Leigh and Mount Selinda were carefully worked, using two cows as bait, in order to prove the presence or absence of tsetse within Rhodesia at that time. Every wooded kloof and belt of timber leading over the border was examined, particular attention being given to the valleys of the Busi and Inyamadze, where the examination was carried over the border as far as the border road. Three weeks were spent on this work, several hundred biting flies, chiefly of the genus *Hamatopota*, being collected, but no tsetse. This strongly indicates that at that period no tsetse existed in Rhodesia or within four miles of the border, while from the survey previously done in Portuguese territory it is doubtful if any tsetse existed within fifteen miles of the border. If they did, they were very scarce, none ever coming to my party of carriers. Big game were reported to be not so plentiful as in past years, but this could not account for the remarkable disappearance of the tsetse from such a large area.

I again entered Portuguese territory at Wolverhampton and examined the Puizeze Valley to its junction with the Lusitu, the country around Mafusi's Kraal and the Maronga rubber forests. Tsetse, *G. pallidipes*, were captured east of Mafusi's in the bush country, and also at Maronga at the edge of the heavy primary forests. No fly was seen at all in the heavy forests of the Lusitu basin, in the high lands between the Lusitu and the Puizeze, or in the mountainous country between Maronga and the Haroni.

The net results of these observations show that a considerable shrinkage in the fly belt had occurred since the year 1919, and this had been accompanied by a subsidence of *nagana* amongst cattle on the border farms. That this decrease is temporary and that an increase in fly followed by further losses from *nagana* will occur when conditions are favourable is practically certain.

It was disappointing that the scarcity of fly within Portuguese territory prevented any purely entomological work on the bionomics of the fly being done and our knowledge of this vital part of the problem remains the same.

The periodical disappearance of fly from known fly belts is a well-known phenomenon, but the natural conditions governing these changes are not understood at present. Two causes working together probably have the greatest influence. These are:—

- (a) Weather conditions, influencing the movement of big game and food supply.
- (b) Parasitism by other insects.

It is interesting to compare the annual rainfall with the increase in *nagana*. There was a fairly heavy rainfall during the season 1914-15, followed by twenty-one cases of *nagana* between February and March, 1915, on East Leigh. The season 1915-16 was a dry one, and no cases of *nagana* were reported from the eastern border. The season 1916-17 was another wet one, and five cases were reported from Stirling. The very wet season 1917-18 was accompanied by a heavy mortality on Stirling, five cases in 1917 and twenty-six cases in 1918. The effect of

this abnormal rainfall seemed to have continued over into 1919 and 1920, the losses being: Stirling, 1919, ten cases; 1920, twelve cases. East Leigh, 1919, seventeen cases; 1920, thirty-five cases.

In 1921 the epizootic had subsided, only seven cases being reported from East Leigh.

From these figures there appears a definite connection between the annual rainfall and the spread of trypanosomiasis in cattle, which may be caused by the wider movement of big game during the rains. The seasonal movements of the fly belts may, however, be governed independently of game movements, a large area of deciduous forest country offering insufficient shade during the dry season, but being good fly country after the trees have flushed into leaf. Of the other factors influencing the movements of fly belts, that of parasitism is a totally unknown factor, while the question of food supply and the relation of big game to tsetse is being worked out in the Wankie district.

It is a remarkable fact that no tsetse fly have ever been seen on the Rhodesian side of the border, though several competent observers have been continually on the watch for them. This suggests that the outbreaks may be due to mechanical transmission by flies other than tsetse. The history of the cases and the conditions prevailing strongly supports this theory. Most of the infected farms are situated within the ranging limit of carried flies, that is, an infected fly could be carried over the border by game or man and so commence the infection. The conditions on the high moorland farms are unsuitable for a forest-loving fly, and it is hardly possible that the tsetse or tsetses carried over would remain and infect a herd over a considerable period without being seen.

Biting flies—*Stomoxa*, *Lyperosia*, *Tabanus* and *Hæmatopota*—were, however, very abundant, particularly on East Leigh and Bayswater, in October, and once the disease had commenced, all the conditions necessary for its spread by these other insect vectors were present.

As most of my time was spent proving the presence or absence of tsetse in Rhodesia, and as I was unable to do any entomological work in Portuguese territory owing to the absence of fly from the district examined, I am not in a position to make any recommendations or suggest preventive measures. Much research work is being done in this country by the Department of Agriculture on the bionomics of the tsetse fly, and also in other parts of Africa, and it is hoped that when our knowledge of all the conditions governing the life of the tsetse is more complete we shall be able to combat the pest.

As a precautionary measure, stock owners ought to graze cattle on the land adjoining Portuguese territory as little as possible, and never during the wet season when other grazing is available.

Summer Irrigation in Rhodesia.

By A. C. JENNINGS, Assoc.M.Inst.C.E., Government
Irrigation Engineer.

It may appear somewhat anomalous that any form of irrigation should be necessary in this country in the summer or wet season of the year, but an endeavour will be made here to show such is often the case.

If the available rainfall figures are carefully studied it will be found that in Southern Rhodesia, which has an area of 150,344 square miles, the distribution over the country is approximately as follows.—

Average Annual Rainfall.	Area in Square Miles.
Under 20 inches	13,530
20 to 25 „	29,166
25 to 30 „	63,745
30 to 35 „	29,467
Over 35 „	14,436

A region in which the rainfall is less than 20 inches is usually considered semi-arid, and from the above it will be seen that in normal years an area of 13,530 square miles would fall within this category. It must, however, be realised that the seasons are seldom normal, and the standard deviation from the mean rainfall* is as much as 7 inches above or below, with a preponderance of years on the side of sub-normal. Thus an area having an average rainfall of 20 to 25 inches may, in every three out of five years, receive only about 13 to 18 inches of rain, bringing the 29,166 square miles to below the 20-inch mark and increasing the semi-arid area to 42,696 square miles, equal to over one quarter the total area of the country.

In sub-tropical countries a rainfall of less than 20 inches, except it is very well distributed over the growing season, is usually insufficient to produce a maximum yield or mature a commercial crop; the reason for this being that, of the rain which falls, at least 75 per cent. is lost by evaporation, run-off, etc., leaving possibly only 25 per cent. retained in the soil for the use of crops. With a 20-inch rainfall this would mean that no more than 5 inches would be thus available, or equal to 566 tons of water per acre. Now an ordinary mealie crop

* "Climatic Areas in Southern Rhodesia," *Rhodesia Agricultural Journal*, vol. 19, No. 4, August, 1922.

requires about 600 lbs. of water for every pound of dry matter produced; thus with 560 tons of water per acre only 1,887 lbs. of dry matter would be produced, equal to perhaps half a ton of stalks and four bags of mealies, which can hardly be considered a commercial crop. It will therefore be seen that a rainfall of the magnitude stated must be supplemented by irrigation if successful crops are to be grown.

IRRIGATION IN MATABELELAND.

A considerable portion of the 42,696 square miles mentioned above as being semi-arid, or on the border line thereof, falls in Matabeleland and embraces some of the best occupied areas in which good arable land is found. Agriculture in which entire reliance has to be placed on the summer rainfall has been found uncertain, and for this reason that part of the country has been generally regarded as pastoral rather than agricultural. According to the available statistics, about 2,000 acres of land are under winter irrigated crops, but strange to say, little or nothing has been done in the way of summer irrigation where obviously it is most required.

The rivers of the western side of the Territory have generally poorly sustained perennial flows, but carry large quantities of storm water for considerable periods during the rainy season, and by the utilisation of a portion of this storm flow the agricultural wealth of Matabeleland might be enormously increased. To achieve this object it is not necessary to construct large and costly storage works, but the erection of weirs and the construction of canals will enable this water to be led out by gravitation for the irrigation of any suitable areas of arable land situated within a moderate distance and elevation of the rivers. Such schemes may be termed storm water irrigation schemes, and thus irrigation can be made to supplement the rainfall by the application of water during the long dry spells which frequently occur between successive rains and at such other times when a little water often means the difference between success and failure of the crop. Irrigation works of this nature can be carried out at a moderate capital cost, usually not exceeding about £5 per acre irrigated; and once their value and utility have been proved might well be the forerunners of larger schemes in which storm water would be conserved behind large dams for irrigation during the dry season. In this manner considerable areas of good soil, which to-day produce perhaps 3 or 4 bags of mealies per acre in the season, could be made to produce two or three crops per annum, all of which could be utilised for dairying, fattening of stock and other purposes.

IRRIGATION IN MASHONALAND.

Conditions in this part of the Territory are somewhat different from those mentioned above, in that well over 60 per cent. of its area or some 50,000 square miles has an average annual rainfall exceeding 25 inches. This enables summer crops to be grown with a reasonable degree of certainty, especially in such favoured areas as the Mazoe and Lomagundi maize belts. In many parts of Mashonaland the rivers

have small but well sustained perennial flows, and these are being increasingly utilised for irrigation, so that there are to-day approximately 8,000 acres under winter irrigated crops. This area is likely to be considerably increased within the next few years as soon as economic conditions improve, and profitable outlets are provided for the surplus dairy and other products of the country.

It may well be asked, where then is the need for summer irrigation in a country having such a high and almost assured rainfall?

The answer to this question is somewhat paradoxical, and will be found in a closer scrutiny of the rainfall figures

The true value of the total annual rainfall is largely determined by the manner in which the rain occurs, and thus, while 30 inches may fall during the season, its incidence can well be such that the crops are not fully benefited and small yields are obtained. In addition to the enormous evaporation losses, which in all sub-tropical countries such as this are very large, there are often experienced long dry spells during the growing season which are most detrimental to crops, especially such as citrus and tobacco. These dry spells are of more frequent occurrence than is sometimes realised, and the following figures for Salisbury as given by the Government Hydrographic Engineer will make this more clear.

Year.	Total rainfall. Inches.	Period of dry spell.		Length of dry spell. Days.	Rainfall during dry spell. Inches.
		From	To		
1898-99	38.45	Dec. 28	Feb. 4	39	2.12
1902-03	20.62	Nov. 26	Jan. 3	39	1.07
1903-04	30.60	Dec. 1	Dec. 19	19	0.39
1904-05	30.22	.. 19	Jan. 6	19	0.50
1905-06	27.82	.. 27	.. 14	19	0.23
1906-07	38.28	.. 17	.. 1	16	0.15
1907-08	28.31	Jan. 5	.. 24	20	0.20
1912-13	32.74	.. 10	.. 23	14	0.25
1913-14	28.26	Nov. 29	Dec. 26	28	0.40
1915-16	23.49	Dec. 17	.. 28	13	0.11
1921-22	18.00	Jan. 1	Jan. 31	31	0.19

The above rainfall figures for Salisbury, which are more or less typical of the rainfall in the agricultural areas of central Mashonaland, will show that in 22 years there have been 11 years in which

dry spells of 14 days and upwards have occurred during the critical growing months of November, December and January. On many farms little or no facilities exist for irrigation on any large scale, and on others such facilities as exist are often not utilised to the best advantage.

In the maize areas there are many streams which carry large quantities of water during the wet season, and there is no reason why, by means of comparatively inexpensive irrigation works, this water should not be brought on to the land and applied to large areas of maize and other crops. In some seasons no irrigation might be required, but in others one or two applications of water would save the crop and ensure a good yield in place of failure.

Existing canals utilised at present for winter irrigation could also be used for summer irrigation, and tobacco growers especially should make the most of any suitable land commanded by such canals for their early tobacco. To-day a good deal of the hazard of tobacco growing is caused through over reliance on the seasonal rainfall, and the provident grower will take steps to see that any lands capable of being irrigated are used for at least a portion of his crop.

In citrus cultivation irrigation sometimes has to be maintained right through the wet season; in fact, during the present year (1922) the groves on the Mazoe Citrus Estates have been irrigated at regular intervals from January to the end of October.

GENERAL.

The distribution of rainfall in Southern Rhodesia is unfortunately not so ideal as might be desired; and although a large portion of the country has a regular and sufficient rainfall, a good deal of this occurs in parts of the country which are by no means the richest from an agricultural point of view. Up to the present, settlement has largely taken place along the spine of the country, more or less following the main railway routes at elevations exceeding 3,500 feet. In this way the rich fertile areas at the lower elevations have not yet been touched, and these, lying mostly in the regions of low rainfall, will require irrigation for their full development. Fortunately these areas, situated mostly in the southern parts of the Territory, are intersected by large rivers which rise in country of higher elevation and greater rainfall, and thus receive enormous volumes of water during the summer season. With suitable storage works this storm flow could be conserved and utilised for the irrigation of hundreds of thousands of acres of land. The full realisation of such schemes may take many years, but it is in this direction that Rhodesia must look if she desires to become the large producer and exporter that seems so desirable for her economic stability and well being.

Forestry in Southern Rhodesia.

PLANTING AND CARE OF FOREST TREES.

By J. S. HENKLL, Forest Officer.

In the course of my visits to farms in Southern Rhodesia it has frequently been noticed that poor results have been obtained on otherwise good sites because trees have been wrongly planted and wrongly treated.

It is proposed in this bulletin to give advice as to methods of procedure which will ensure the most favourable conditions for trees to thrive and yield the best returns, and to supply answers in a handy form to the many questions put to the Forest Officer as to the best methods of planting and taking care of the young trees.

As the conditions in Southern Rhodesia in regard to elevation, climate, aspect, geological formation, etc., vary from district to district, and even from farm to farm, it is not desirable for the purposes of this bulletin to indicate the species of trees to grow. For the present better results will be obtained if those persons interested in arboriculture will communicate with the Forest Officer, indicating the situation where it is proposed to plant trees. In the forest office data in regard to rates of growth, adaptability, value, etc., of timber trees both indigenous and exotic are being accumulated. Based upon these data and the record of successes and failures, advice is given to each applicant as to the probable results which may be obtained with different kinds of trees in any specified locality.

OBJECTS OF PLANTING.

The object of planting trees varies with each individual. Generally the objects may be brought under three heads, namely:—

1. Planting for the purpose of beautifying the homestead and making the conditions pleasanter and more healthful, thereby increasing the value of the property.
2. Planting for the production of timber and fuel for home consumption.
3. Planting for the production of commercial timber as an investment.

SELECTION OF SITE.

Whatever may be the object in planting trees, it is desirable to select the best site available on a farm. Generally the site should be that having the deepest soil, for in this country with its long dry winter a tree makes considerable demands on the water supply, and it is only the deep soils which can conserve and retain sufficient to tide over the dry winter period and periodical droughts. Next to the depth of soil, it is important that the site should have good drainage. Lastly, select the highest part on a farm, having if possible an eastern or southern aspect.

PREPARATION OF THE LAND.

Having selected a suitable site, the next operation is to prepare the land for planting. The more thoroughly this is done the better will the trees grow. If it is possible, plough, disc and harrow the land. Where this is impracticable, hand-hoe the whole surface. By any means available endeavour to reduce the soil to a good state of tilth. If for any reason manure is to be used, it should be applied in a well rotted form at the time of ploughing or hoeing the land. The distance apart to plant the young trees should be determined and the site for each tree marked on the ground. If a planting chain or wire is to be used, the espacement pegs should be placed at convenient distances depending upon the length of the planting chain.

REMOVAL OF PLANTS FROM NURSERY BEDS.

If seedlings, by which is meant young trees originated from seed in a nursery bed which have not been transplanted, are to be used for establishing a forest, the following precautions should be observed. The nursery beds should be well watered to soften the soil so that, in the process of removing the seedlings, the root hairs are not injured more than is necessary. A sharp spade is a useful implement for lifting the plants. Remove the earth gently; shorten any long roots by means of a sharp knife and place the seedlings in a basket, box or bag or other suitable receptacle. Cover the roots with moist leaf-mould, moss or moist soil. As a further precaution to prevent injury to the root hairs, the seedlings, immediately after lifting, may have their roots dipped in a puddle of clay, cow-dung and water, so that a thin layer is deposited on them.

The best time to remove the seedlings from the nursery bed is early in the morning. The boxes containing the seedlings should be protected from wind and kept in shade and transported to the planting site as required. In some cases, where seedling eucalypts are on the large size, pruning of the crown is necessary in order to obtain plants with well-balanced root and shoot systems, for if the development of the crown be much greater than that of the roots, the former will make demands which the latter cannot supply, and death may ensue.

It is well constantly to bear in mind when dealing with young plants that the roots are fitted with exceedingly delicate root hairs, the finest of which are not perceptible to the naked eye. On these

root hairs depend the life of the plant and its success in re-establishing itself in the site where it is to grow permanently. A very short exposure of the roots to the sun and dry air is sufficient to dry and render them useless. Hence the importance of careful handling. Carelessness will result in an undue proportion of failures.

REMOVAL OF PLANTS FROM TRAYS.

If the young trees are "transplants" in tin or wooden trays, the trays should be transported to the planting site and well watered immediately before the young plants are extracted. The transplants should be removed one by one and planted with balls of earth adhering to their roots.

PLANTING SEASON.

Planting should be done in the summer or autumn after good soaking rains have fallen. January, February and March are usually the best months for planting out. If possible, plant immediately after a good soaking rain has fallen and on a damp cloudy day, so that the plants may establish themselves before the next period of dry weather sets in. Do not plant when a dry hot wind is blowing. Do not plant in clay soil when it is very wet. There is much to be said in favour of both summer and autumn planting. In the former case the trees undoubtedly have the advantage of the full growing season, but so have the weeds. Only by constant weeding can the young trees be kept free from weed growth. In the latter case the trees still have the advantage of moist soil conditions, but the weed growth has lost its vigour, consequently weeding operations are less frequent and less costly. In either case autumn cultivation should be undertaken, as this will tend to conserve the soil moisture. Trees planted in the autumn of a normal rainy season generally manage to establish themselves. The roots follow the sinking water table, and, although height growth is not great and the leaf surface small, which is an advantage, trees manage to live through the dry winter months. The late planted trees frequently are less susceptible to frost than the heavy foliated trees planted in early or mid-summer. When the first rains fall in the ensuing season these trees, being thoroughly established, grow vigorously and soon suppress and kill the weed growth. The summer season of 1921-22 was one of low rainfall, yet mortality amongst trees which were properly planted late in the season in well prepared ground is surprisingly small.

SIZE OF SEEDLINGS AND TRANSPLANTS.

In forestry practice in South Africa it is usual to set out transplants grown in trays when they are about six inches high. Frequently the plants are only from two to four inches high. These young trees do not have interlaced fibrous roots, and are easily dug out of the trays without injury to the roots. Larger trees, which usually have been a correspondingly longer period in the trays, have interlaced roots, and many of these are broken or cut in the act of removing the trees from the trays. A small tree having uninjured roots soon establishes

itself and produces a better stem than is the case with a larger plant set out with an injured root system. At the same time it must be admitted that, where the soil is liable to be drier than is desired, larger and stronger rooted plants are required, though unless well planted they may succumb to drought more quickly than smaller plants. In dry hot soils the thin stems of the latter are liable to be ring-barked by the heat. It has also been noted that the stronger plants are less liable to injury by locusts and other foliage eating insects.

For Rhodesian conditions plants from six to twelve inches are to be preferred to larger ones if the climatic conditions are favourable and the superficial layers of soil are sufficiently moist. Always discard weak lanky plants.

DENSITY OF PLANTING.

The number of plants to be set out per acre is dependent upon the object the tree-planter has in view. For ornamental planting about a homestead the trees may be required for avenues, groups, belts or as single specimens. In such cases individual taste and preference must determine the espacement. For the production of fuel or timber an espacement varying between six feet by six feet and ten feet by ten feet may be adopted. A good average espacement for most trees is eight feet by eight feet. In the case of square planting, the following table gives the number of plants per acre for the various planting distances :—

Distance.	Number.
6 feet	1,210
7 "	889
8 "	680
9 "	536
10 "	436

PLANTING.

"Good planting is the foundation of the success of all forest plantations, and bad planting is responsible for more failures than any other factor, except, perhaps, unfavourable climatic conditions."—(Sylviculture by Forestry Commission, New South Wales, page 99.)

If this statement is true for the conditions in New South Wales, it certainly is for Southern Rhodesia. Time and again it has been noticed that where there is danger of failure the plants which succumb are those which have not been properly planted.

In tree planting it is a fixed rule that the young tree be planted at the same depth as it stood in the nursery bed or tray. Failure to observe this rule is one of the primary causes of non-success. Covering with soil any part of the stem above the collar interferes with the free flow of food supplies which have been elaborated by the chlorophyll in the leaves. The layer of soil covering the bark above the collar prevents the lenticels from performing their normal functions and intercepts and prevents the food-stream reaching the roots; the latter, as a consequence, are unable to supply the leaves' demand for water,

and, as a result, the whole plant is enfeebled and dies or falls a ready prey to termites.

In nature termites are scavengers and do not ordinarily attack healthy trees, provided these are adapted to the local climatic and soil conditions. That this is so may be observed in most parts of the territory, where the best and largest trees, both indigenous and exotic, are found on termite mounds.

If the trees to be planted are small and in trays, they should be carefully removed by means of a gardener's trowel, retaining as much earth as possible round the roots. Before actually removing the transplant from the tray, dig a hole at the selected site big enough to receive the plant. Remove from the hole any grass or roots likely to cause air cavities. Place the transplant into the hole slightly above the correct height to allow for the sinking of the soil; fill in earth closely round the roots, leaving no air cavities; firm with the fingers of both hands and finish off with further firming with the feet. After the tree has been planted, make a small saucer-like depression and water at once to settle the soil.

In the case where seedlings, having no balls of earth round their roots, are being used, it is advisable to insert the plant as deeply as it will go in the hole, spread out the roots in a natural position and gently raise it to the correct height as the hole is being filled, thus straightening the roots. The seedlings should be taken from the planting box as required and placed in position immediately, so that the delicate roots are not exposed unnecessarily. If labourers are not carefully instructed and supervised, it will be found that they will take the seedlings in handfuls, instead of one by one. From first to last the roots should be exposed to the air only on two occasions, namely, when being lifted from the nursery beds and when being planted.

FILLING BLANKS OR VACANCIES.

Though every effort may be made to secure the trees being planted correctly, it seldom happens that some do not die. The proportion varies from many causes, such as unfavourable weather immediately following planting; poor condition of the seedlings or transplants; lack of sufficient superficial moisture; improperly prepared land; grasshoppers; cutworms or other insects. It is therefore necessary to hold in reserve a supply of the same age plants to fill any blanks which may occur. The filling of blanks should take place systematically from the time failures are noticed until weather conditions no longer permit trees being planted. With few exceptions, it is not worth while filling in during the following season.

WEEDING AND CULTIVATING.

The labours of a tree planter do not cease after he has planted his trees and filled any blanks which may have occurred. Constant attention is necessary. It is necessary to keep the surface free from weeds and grasses which will assert themselves and begin to interfere

with the young trees by preventing them from enjoying the full benefit of moisture, sun and air. If the undesirable growth is not destroyed or checked the young trees will become "drawn" and weakened and in some cases killed. To prevent this, weeding should be undertaken. The best time to weed is as soon as a green tinge is noted. At this stage the newly germinated seedlings are most easily killed. Use any implements or tools available, such as cultivators, spades, hoes, etc. It is not always possible to weed at the right time, and it may be that the weed growth has attained to some height before weeding operations can be undertaken. In such a case the destroyed weed growth should be left on the ground to act^e as a mulch and conserve moisture as well as preventing further weed growth.

Cultivation should be carried out at frequent intervals during the summer and autumn, as this not only keeps down weeds, but keeps the soil in the best condition to absorb and retain moisture. When canopy begins to form, cultivation may be discontinued. The shade produced by the trees will prevent further weed growth and the accumulating fallen leaves will form a covering for the soil.

During the process of weeding the greatest care must be taken not to pile earth round the stems of the young trees. This is particularly liable to happen where weeding operations are carried out by native labourers using hoes. The habit of the natives of this country of piling earth round the stems of young trees is, next to the incorrect methods of planting already mentioned, another great cause of failure. Unfortunately most of these failures are attributed to termites (white ants), and hence the idea, by no means uncommon, that it is impossible to grow trees because of the presence of white ants. Healthy and vigorously growing exotic trees found in many parts of the country are sufficient proof that this is not the case.

To be sure that earth has not been piled round the stems it is a wise precaution after each weeding or cultivation to send another gang into the young stand with instructions to remove the earth which has been piled round the stems by the previous gang.

CLEANING AND PRUNING.

In a plantation established where there was formerly a growth of indigenous trees and shrubs it frequently happens that seedlings of undesirable species, sucker and coppice growth, appear and grow vigorously. From time to time this growth must be checked, or it may dominate and suppress the planted trees. Various creepers and twining plants have also to be removed. Given a favourable season, the young stand of forest trees will soon give evidence of having established itself. Like every other living thing, a young tree is exposed to many dangers. An insect or a bird may injure the leading shoot; a stray animal may browse the top or otherwise injure the tree. A strong wind or a late frost may leave its mark, or in its desire to increase in bulk the young tree may develop two or more leading shoots. Whatever the injuries or defects, in most cases man can remedy them.

When the trees of a young wood are about 5 to 7 feet high, each tree should be examined and any double leaders removed. Strongly developed branches should be shortened so that the tree may produce one good straight stem. An ordinary clasp knife is all that is necessary for the operation. Such trees as poplars, cedrelas and jacarandas require special care to prevent the growth of heavy branches. In the case of these trees, merely rubbing off the axillary buds will suffice. Amongst the eucalypts, *Eucalyptus rostrata* is especially liable to forking and branching when young, but a little judicious pruning in the manner indicated will induce straight growth.

After the young trees have formed canopy, that is, when the ground is completely shaded by the foliage, thinning operations begin. Advice about thinning will be found in bulletin No. 366.

PROTECTION.

In places where the young trees are likely to be injured by cattle or other animals the planted area should be protected by a temporary fence, which can be removed when the trees are big enough to be out of danger.

To prevent injury from fire, proper fire guards should be cleaned all round the planted area.

SUMMARY.

This bulletin gives advice that will enable a farmer to grow trees with every prospect of success.

The farmer should---

1. Get advice from the Forest Officer as to the best trees to grow in the locality in which he resides.
2. Select the best site available on the farm.
3. Properly prepare the land.
4. Handle seedlings and transplants with the greatest care.
Do not allow the roots to become dry.
5. Plant the trees when climatic conditions are most favourable.
6. Plant a good grade of plants. Poor plants don't pay.
7. Plant seedlings and transplants the same depth they stood in the nursery or in trays. Deep planting kills.
8. Fill blanks or vacancies as soon as they occur. A perfect stand is wanted.
9. Cultivate and weed the young trees thoroughly. Don't let weeds grow. The tree needs the moisture.
10. Never pile earth round the stems of young trees. The food supply is cut off.
11. Prune the trees to single stems. Double leaders and heavy branches decrease the value.
12. Protect the young forest from stock and fires. The trees are worth it.

Annual Report of Experiments, 1921-22, Experiment Station, Salisbury. (Concluded.)

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist.

LEGUMES.

This year it was apparent throughout the whole season that leguminous crops as a class were vastly superior to any other as drought resisters, and that whereas velvet beans, Dolichos beans, Kudzu vine, beggar weed and ground nuts produced yields that were almost normal, all other crops such as buckwheat, linseed, sunflower, maize, etc., generally gave very reduced yields.

Velvet Beans.—A comprehensive summary of the work done with this crop appeared in the February issue of this Journal. The experimental work now in hand comprises trials to determine the relative value of new varieties, to test its possibilities as a grain crop when sown with maize, and to ascertain the best methods of growing it for ensilage in conjunction with maize.

Among the new varieties was one—*Stizolobium taborense*—received from the U.S.A. Department of Agriculture. This produced very vigorous growth, which was characterised by having its runners more erect than the varieties hitherto grown. As will be seen from the table below, the yield of beans was high, and the variety deserves, and will receive, further attention. It is interesting from the fact that it may prove to be identical, botanically, with our own white stingless bean, though somewhat slower in maturing. A native strain sent in by Mr. J. M. Moubray, of Shamva, gave such poor germination that weights per acre could not be calculated. It is not, however, likely to be of economic value owing to the presence of irritating hairs, the absence of which on the white stingless is one of its principal advantages.

Variety.	Yield of grain per acre
<i>Stizolobium taborense</i>	999 lbs.
White stingless	798 lbs.
Florida	600 lbs.



Plate I. Woodforde's Dolichos Bean, first season. Salisbury Experiment Station.

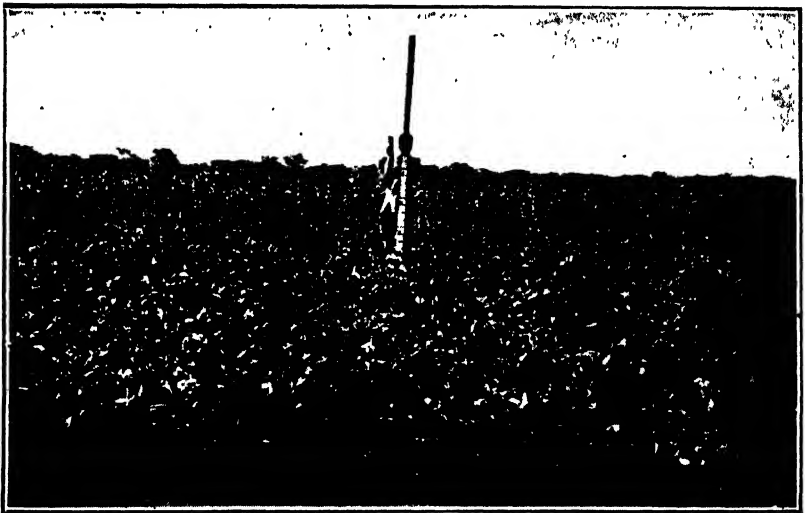


Plate II. Woodforde's Dolichos Bean, two seasons' growth. Salisbury Experiment Station.





Plate III. White Dolichos Bean, two seasons' growth.



Plate IV. Cassava. Three-year-old plants. Salisbury Experiment Station.

The white stingless variety in the rotation plots gave yields of 1,000 and 1,010 lbs. seed per acre, while another plot after oats yielded 804 lbs. of seed per acre.

When grown in conjunction with maize—both crops for grain—yields of velvet beans in addition to the maize at the rate of 486 lbs. per acre were obtained when planted 15 inches apart in the row, and of 529 lbs. per acre when 24 inches apart in the row. These results show the feasibility of growing the two crops together, but as yet do not confirm the advantage in yield of beans due to this method which is claimed in American trials.

Tests to determine the comparative weights of green fodder obtainable from velvet beans, when grown in different ways in combination with maize for ensilage, gave the following results in this season of exceptional drought:—

Both crops.	Velvet bean fodder.	Maize fodder.	Total per acre.
1. Sown simultaneously in same rows	2,992 lbs.	6,920 lbs.	9,912 lbs.
2. In same rows, beans sown 14 days previous to the maize	5,284 lbs.	2,436 lbs.	7,720 lbs.
3. In same rows, beans sown 14 days after the maize	904 lbs.	10,932 lbs.	11,836 lbs.
4. Sown simultaneously in alternate rows	3,528 lbs.	6,784 lbs.	10,312 lbs.

Where the beans were sown before the maize in No. 2 they made vigorous growth, while the maize sown later suffered severely from drought. The reverse was the case in No. 3, although the beans throughout all the plots were more drought resistant than the maize.

Dolichos Beans.—Various beans likely to rival the velvet bean as fodder producers have been introduced from time to time. Of these the Dolichos Lablab or hyacinth bean thus far has proved the most promising, both for fodder and grain. Like the velvet bean, the Dolichos proved itself an excellent drought resister, and in some cases the plants proved perennial by surviving the winter of 1921 and producing crops again in 1922. The yields of grain and fodder given below show that these crops may possibly be usefully utilised to supplement or perhaps replace velvet beans under certain conditions.

	Green fodder per acre (1920-21).	Grain per acre (1921-22).
Pyewell's Dolichos ... ..	...	480 lbs.
Woodforde's Dolichos	14,300 lbs.	614 lbs.
White-seeded Dolichos	18,700 lbs.	480 lbs.

Other varieties of Dolichos tried include the stringless Lablab, which is of repute as a vegetable, and others whose varietal names are at present uncertain.

Cowpeas.—Four varieties of the bush type reputed to be resistant to root disease, namely, victor, iron, Brabham and Monetta, received from the U.S.A. Department of Agriculture, deserve mention on account of the fact that with these varieties and for the first time for many seasons satisfactory growth and yields were obtained. The plants were not entirely free from bean-stem maggot attack, but vegetative growth was excellent and the yields of iron and Brabham exceeded three bags of seed per acre. The plants were all of distinctly bush type, without any prostrate runners, and reached an average height of 2 feet.

Sweet Clover Varieties (*Melilotus* spp.), including Hubam clover, have been under observation for several seasons. It cannot be said that any variety or strain has shown itself adapted to Rhodesian conditions, and neither as hay, seed nor green manure crops can the sweet clovers be recommended for this country. In the same way **Egyptian Clovers**, as a result of continued trial, may be said to be unsatisfactory, except possibly if grown under irrigation. In the case of irrigated **Lucerne**, further cultural trials and tests with bacterial cultures have been undertaken, but it is as yet too early to report on the results. No immediate benefit from either seed or soil inoculation is yet evidenced.

Beggar Weed and Kudzu.—These crops, on the other hand, have both proved admirably adapted to local conditions, and both are easy of propagation on a large scale from small beginnings. Beggar weed is an erect legume somewhat resembling lucerne, but with a more woody stem. In Rhodesia it is a perennial, and one plot now four years old is still as vigorous as ever. In normal seasons two or three cuttings for hay or two for seed, together with grazing on the aftermath, may be obtained, and trials with it on a small scale under irrigation show that where water is available rapid and continuous growth is made at all times when frosts are not prevalent. This season, owing to the short rainfall and to the great demand for seed, one cutting only was taken, giving a weight of seed of 213 lbs. per acre. On account of its free-volunteering habit, cultivation may be necessary in an established stand to prevent volunteer seedlings choking out the older plants.

Kudzu vine, on the contrary, does not produce seed in Salisbury, but is easily propagated from the runners, which are produced freely and root readily at the nodes. An article on methods of propagating this crop appeared in the August issue of this Journal. With regard to its fodder-producing qualities, cuttings taken at different dates on separate plots gave the following yields of green fodder per acre:—

Cut 14th January, 1922	15,840 lbs.
Cut 30th January, 1922	11,160 lbs.
Cut 3rd March, 1922	11,424 lbs.

The cutting on 30th January was converted into hay, and after curing gave 3,312 lbs. dry fodder. Owing to drought the later cuttings had dried out considerably, and shed a good deal of leaf before being reaped.

Adjacent plots of Kudzu and lucerne were irrigated early in the spring of 1921, and the following comparative figures are instructive as indicating the great possibilities of Kudzu in this Territory.

Kudzu, irrigated once in August, 1921.

1st cutting 30th September, 1921 ...	7,290 lbs. green fodder
2nd cutting 5th December, 1921 ...	10,314 lbs. green fodder
3rd cutting 2nd February, 1922 ..	12,150 lbs. green fodder
4th cutting 24th May, 1922 . . .	4,968 lbs. green fodder
Total	34,722 lbs. green fodder

Lucerne, irrigated three times.

1st cutting 24th October, 1921 .	486 lbs. green fodder
2nd cutting 1st December, 1921 ...	1,440 lbs. green fodder
3rd cutting 5th January, 1922 .	2,970 lbs. green fodder
4th cutting 11th February, 1922 .	1,350 lbs. green fodder
5th cutting 3rd April, 1922 ..	1,350 lbs. green fodder
Total	7,596 lbs. green fodder

Tepary Bean.—Probably the most remarkable result during the last season was that obtained with Tepary bean. Although not sown until 4th January and with a rainfall on the crop of under 7 inches, a yield of 840 lbs. of beans per acre was obtained. Such a result is rendered even more remarkable by the fact that three varieties of lupines sown on the 16th December and two varieties of field peas sown on 9th January were entire failures.

Native Legumes for Green Manuring.—These include several species of *Crotalaria* (plants closely related to the now well-known Sunn hemp), *Sesbania* species, and a few others. Their value for green manuring is presumed from the fact that they produce nodules freely, but up to the present the trials are not sufficiently advanced to enable a definite opinion on their suitability to be expressed. The great value of Sunn hemp (*Crotalaria juncea*) for this purpose is amply proved by the results of maize following this crop, and previously referred to in this report. At present all that can be said of the native species is that two at least are extremely promising.

Dhal (*Cajanus indicus*) continues to be grown with success, and the yields of grain as shown below can be considered quite satisfactory. None of the varieties introduced from India has proved sufficiently early to mature seed within the compass of a Rhodesian season, except in protected and frost-free areas or on sites where frost is so light as not to affect the crop. Selection is still being carried on to obtain varieties which may ripen grain before frosts usually set in. In any case, however, its value as a grain crop and as a soil improver, combined with its perennial habit, entitle it to a recognised place on the frost-free areas of Rhodesian farms.

Dhal varieties.	Yield of grain.
Maximum yield	1,107 lbs. beans per acre
Minimum yield	513 lbs. beans per acre
Average of seven varieties	736 lbs. beans per acre

The conversion of the tops of one variety into hay resulted in a yield

of dry hay at the rate of 2,088 lbs. per acre. The tops were cut in the flowering and podding stage, but before the beans were ripe. This hay, when chaffed, was freely eaten by mules, cattle and sheep; the two former clearing it up entirely, and the sheep leaving only the coarser pieces of the stem.

Ground Nuts.—In the case of this crop the top growth, although consistently of a good colour, suffered somewhat in luxuriance. The yield of nuts, however, was good, and compares well with that obtained in previous seasons. Two distance plantings with two varieties, each giving the same number of plants per acre, were tried, and also one closer planting, with which was combined an experiment to test the value of ridging *versus* flat cultivation.

Variety.	Date planted.	Distance of plants.	Yield, unshelled nuts per acre.
Spanish	19th December, 1921	30 x 8 ins.	1,266 lbs.
Virginia	19th December, 1921	30 x 8 ins.	1,152 lbs.
Spanish	19th December, 1921	24 x 10 ins.	1,164 lbs.
Virginia	19th December, 1921	24 x 10 ins.	1,188 lbs.
Spanish (ridged)	20th December, 1921	18 x 6 ins.	1,576 lbs.
Spanish (flat)	20th December, 1921	18 x 6 ins.	1,480 lbs.

Average of nine trials, 1,336 lbs. unshelled nuts per acre.

The process of ridging consists of lightly earthing up the crop with the cultivators once or twice during the flowering stage.

If these results are compared with those of previous seasons, it will be seen that the closest plantings even in a year of drought give the heaviest yields, and also that ridging or earthing up the plants is invariably advantageous. The actual distance of planting will be governed by the methods of cultivation it is intended to employ, but it may be pointed out that any spacing of the rows less than 24 inches apart prohibits the use of animal-drawn cultivators.

OTHER CROPS.

Kaffir Corn.—Trials were conducted with fifteen varieties of kaffir corn, and weights were taken both for fodder converted into hay and for grain. The yields of dry fodder varied from 3,224 lbs. to 4,820 lbs. per acre, and of grain from 300 lbs. to 1,360 lbs. per acre. The outstanding variety was that known as "Brown Dhurra," which gave the highest yield in both fodder and grain. The best yielders are given below:—

Variety.	Dry fodder per acre.	Grain per acre.
Brown Dhurra	4,820 lbs.	1,360 lbs.
Yellow Sudan	4,240 lbs.	940 lbs.
Amber cane	3,224 lbs.	936 lbs.
Orange cane	4,000 lbs.	900 lbs.
White Sudan	4,160 lbs.	860 lbs.

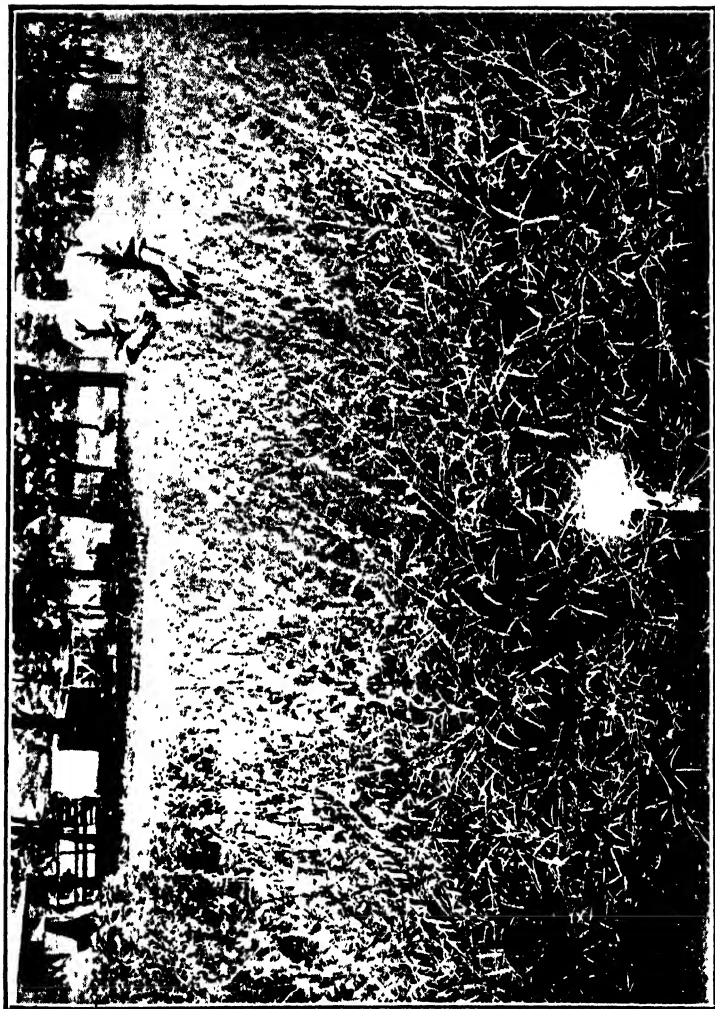


Plate V. Native legumes for green manuring. *Crotalaria maxillaris*.
Salisbury Experiment Station.

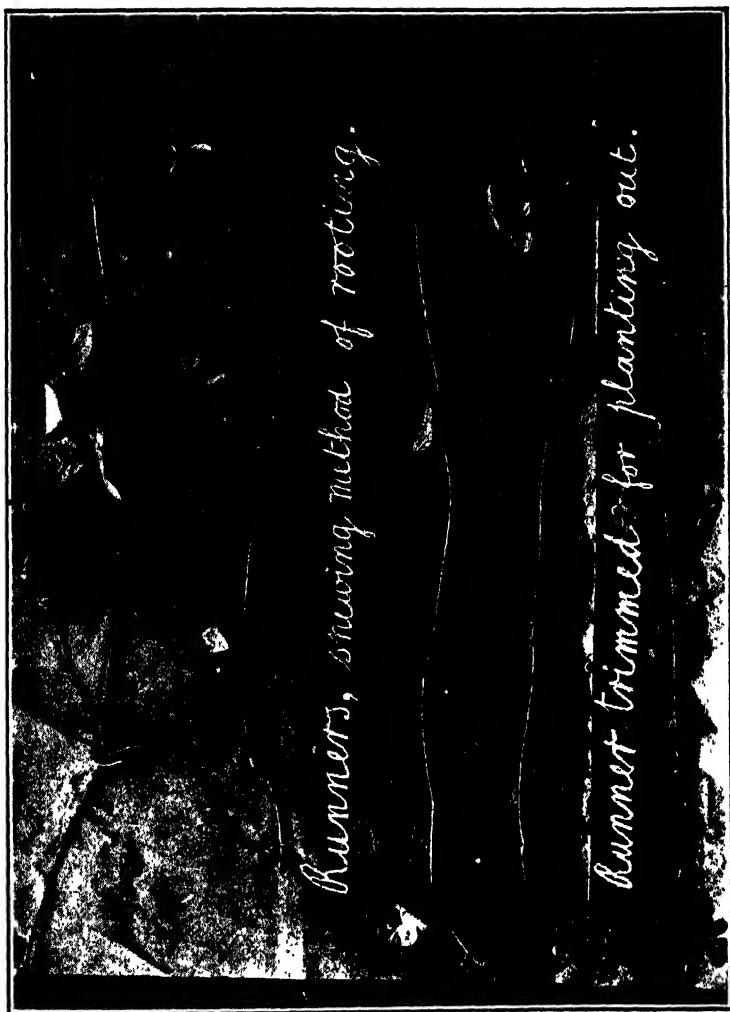


Plate VI. Kudzu Vine, showing habit of rooting and manner in which vines are prepared for transplanting

It will be noted that even in this exceptionally dry season the grain yields from this crop compare unfavourably with those of maize under similar conditions.

Buckwheat.—This crop was sown on the 22nd December, 1921, and with no more than 9 inches of rain gave a yield of clean seed equalling 420 lbs. per acre.

Linseed.—Two of the best varieties for Rhodesia, viz., "White-flowering" and "Large-seeded," were sown on the 20th December, 1921. Considerable loss from sunburn occurred during the January drought, but in spite of this, and of the fact that linseed is a short-season crop, yields of 408 lbs. and 396 lbs. respectively were obtained. The white-flowering variety proved considerably earlier than the large-seeded, the former being harvested on the 30th March, and the latter not being ready until three weeks later (on the 19th April). Several other varieties were tested on a small scale, but in no instance was the yield comparable to those quoted above.

Sunflower.—The ability of this crop to withstand droughty conditions was well illustrated this season, when a plot of the black variety sown on the 10th December grew to a height of 6 feet and maintained excellent colour throughout. The yield of seed harvested on the 18th May was at the rate of 728 lbs. (7 bags) per acre for the black-seeded variety, and 400 lbs. (4 bags) per acre for the striped variety.

Hibiscus cannabinus.—Several varieties of this fibre plant were tried, including the native variety, the true Indian Deccan hemp, and a variety from Northern Rhodesia. The drought adversely affected the height to which the plants grew, the average being about 6 feet, but there was no wilting or other apparent disadvantage. During the retting process, however, it was found that the return of fibre was distinctly lower than under normal conditions of growth, amounting in each case to only one-half of that obtained in 1920.

The native variety grew to a height of 6 feet; 100 lbs. of freshly cut stalks dried out to 62 lbs. (air-dry), and this yielded 2 lbs. 13 ozs. of clean fibre, or at the rate of 4.5 per cent. The Indian variety grew to a height of 4½ feet, and yielded at the rate of 9,000 lbs. of green stems per acre when freshly cut. By the process of air-drying this was reduced to 3,960 lbs., and this yielded 180 lbs. of fibre, or at the rate of 4.6 per cent. Trials conducted in 1920 yielded over twice the above weight of green stems per acre, and showed a fibre content in the air-dry material of 10 per cent. The variety from Northern Rhodesia, and a red-stemmed variety selected locally, germinated very badly and no reliable weights were possible.

Summer Wheat and Oats.—Heavy yields of grain are never obtained from these cereals when grown as summer crops, the inhibiting factor being rust. During the past season, on account of the unusually dry conditions, rust was not very prevalent on either wheat or oats, but as only about 7-8 inches of rain fell on the crop during the growing period the plants lacked vigour and the yield of grain was very low, not exceeding 190 lbs. per acre in the case of wheat, and of 246 lbs. per acre in the case of Kherson oats.

<i>Sudan grass. Sown 1st December, 1921.</i>	Green weight.	Dry hay.
First cutting, 15th February, 1922	...	720 lbs.
Second cutting, 15th March, 1922	..	3,660 lbs.
Third cutting, 12th April, 1922 ...	6,010 lbs.	1,710 lbs.

After Sudan grass, first cutting	1,218 lbs. hay per acre.
second cutting	708 lbs. hay per acre.
After maize .. . first cutting	1,434 lbs. hay per acre.
second cutting	1,560 lbs. hay per acre.

In all cases the Sudan grass continued to make growth, and was safely grazed by cattle and sheep until the advent of heavy frosts.

The attempt to convert sweet potato tops into hay was not very successful, the vines taking a long time to dry out and ultimately providing a very dark-coloured fodder. Six thousand pounds weight of green vines dried out to 1,200 lbs. of hay, indicating a water content of at least 80 per cent. in the fresh vines.

Dhal tops cut when the pods were beginning to form gave dried hay of good quality at the rate of 2,320 lbs. per acre. This hay was of good colour and retained its leaf growth well.

Native Grasses for Hay and Fodder.—Preliminary tests were made with the more promising of the native grasses under trial. These crops were cut and weighed green and then converted into hay. From the figures given below it will be seen that some of our native grasses hold out very considerable possibilities.

	Green weight per acre.	Dry weight per acre.
Molasses grass (<i>Melinis minutiflora</i>) .	17,200 lbs.	6,800 lbs.
Wild paspalum (<i>P. scribiculatum</i>) ...	16,800 lbs.	6,160 lbs.
Tussock grass (<i>Setaria lindenbergiana</i>) ...	11,840 lbs.	6,080 lbs.
Buffalo grass (<i>Setaria sulcata</i>) ...	12,480 lbs.	3,760 lbs.
Purple-top Buffel grass (<i>Panicum maxi-</i> <i>mum</i> variety)	8,160 lbs.	4,240 lbs.

Yields for adjoining imported grasses are as follows:—

Upright paspalum (<i>P. virgatum</i>) ...	10,320 lbs.	3,360 lbs.
Natal grass (<i>Pennisetum unisetum</i>) ...	8,960 lbs.	3,920 lbs.
<i>Pennisetum cenchroides</i>	8,560 lbs.	6,160 lbs.

Coarse Fodder and Succulent Crops.—The following figures giving weights of green fodder are of interest, as indicating certain directions in which these crops may be turned to account.

	Date of cutting.	Green weight per acre.
Napier fodder—		
(a) Once irrigated (October, 1921) ...	14.1.22	30,000 lbs.
(b) Not irrigated	14.1.22	17,000 lbs.
Kudzu vine, not irrigated ...	14.1.22	15,804 lbs.
Kokoma grass (<i>Rottballia esaltata</i>), not irrigated ...	14.1.22	14,400 lbs.

In each case subsequent cuttings were obtained, the weights of which were not recorded.

Succulents.

Velvet bean tops ...	Cut 4.2.22	6,144 lbs. per acre
Sweet potato tops ...	„ 4.2.22	6,240 lbs. per acre
Sweet potato tubers, average yield		10,000 lbs. per acre
Cassava roots planted from cuttings		
15th November, 1921 ...	June, 1922	9,180 lbs per acre

CROPS EXPERIMENTED WITH UNSUCCESSFULLY.

The following crops sown in the latter part of December and early January failed to mature owing to drought.—Late planted maize, rye, certain sowings of oats and buckwheat, teff, peas, pumpkin varieties, Ceylon cattle melon, bean varieties from Dar-es-Salaam, Niger oil grown for seed, lupines, Niger oil and oats undersown between maize and chillies. Jute failed for the third year in succession, and will not again be tried. Opium poppy and perilla failed to germinate, both for the second year in succession.

Some Common Diseases of Poultry.

By A. LITTLE, Poultry Expert.

THE RESPIRATORY SYSTEM.

Aspergillosis.—This disease, often known as brooder pneumonia, is caused by a fungus of the genus *aspergillus*. There are five different species of these, which are usually found growing upon dead organic matter; they have great resisting power and can adapt themselves to various conditions.

Cause.—These various species of *aspergillus* exist and grow, especially in warm weather, upon musty straw, musty grain, old leather, etc. From these materials vast numbers of the spores of the fungus are inhaled by the fowls. Although many birds may be exposed to these spores, a few only may be infected by them and develop aspergillosis. It may be that some birds, having less vitality than others, are more likely to contract the disease, or it may be that some are more predisposed to it than others. It has certainly been noticed that the delicate and weak individuals are the first to become affected.

Symptoms.—The onset of this disease is very insidious; it is only after the bird has had the disease for some days that symptoms are noticeable, and then it is observed that it becomes weak, is able to stand up with difficulty; it continues to lie down, resting on the keel, is sleepy, and, if roused, runs a few steps and then falls. The feathers are ruffled, the wings droop, the head is held down and the eyes half closed. The main symptoms are connected with the respiration, which is laboured and quickened, while a rattling sound is heard during expiration, and the bird is continually opening its beak in order to obtain more air. The bird is thirsty, and there is little or no appetite; there are exhaustion, emaciation and diarrhoea in the later stages, and finally death.

Post-mortem Appearances.—These may be of two natures, viz.: (1) On the mucous membranes of the air passages and sacs, a thin membranous formation, with a growth of fungus upon its surface in patches, which are yellowish or greenish in colour. The mucous membrane is thickened and inflamed and frequently ulcers are seen on its surface. If the disease has been acute and rapid, there may be seen simply inflammation of the lungs and pus or abscesses in them; the kidneys, liver and spleen are similarly affected. (2) There may be seen in the tissue of a number of organs small nodules like those of the tubercles in tuberculosis. These are of a yellowish, whitish colour,

and in size vary from that of a pin head to that of a pea. They may be separate or joined together in patches. The disease more often attacks young chicks than adult birds.

Prevention.—Avoidance of musty hay, straw or litter of any sort in the houses and runs, all houses should be kept clean, dry and well ventilated. Burn all carcasses of birds which die.

Treatment.—The disease is difficult to cure and eradicate. Once it commences it rapidly spreads. Individual treatment is not often successful, therefore every means should be taken to prevent the disease breaking out. The best treatment is fumigation with tar vapour. To do this the birds should be shut in a tight room and a tablespoonful of wood tar placed in a pint of water and stirred with a hot iron. As an alternative a brick, a stone or a piece of iron may be heated and the tar poured on drop by drop. The birds are forced to breathe the vapour, which should be so dense as to cause irritation.

Diseases in which some of the symptoms are similar to those of aspergillosis are—

Gapes.—Laboured breathing and open mouth. This disease is very rare, in fact, it is practically unknown in Rhodesia.

Bronchitis.—Laboured breathing, but a rattling, gurgling sound is heard in the throat and lungs. This sound is not heard in aspergillosis.

Pneumonia.—Laboured breathing, with a soft, purring sound similar to that heard when the finger is rubbed over plush. This is not heard in aspergillosis.

Pneumonia (Inflammation of the Lungs).—This disease is not so common in birds as it is in animals; still, quite a number of cases occur, especially at the beginning of the wet season. The disease is rapid and usually fatal.

Cause.—The lungs become congested, due to cold, damp, a stuffy atmosphere, or the breathing of some irritating vapour. This congestion, especially if certain bacteria are present, unless checked, will quickly develop into pneumonia.

Symptoms.—Rapid, difficult and seemingly painful breathing. Ruffled feathers, drooping wings, the head and neck are frequently drawn towards the chest. The bird has a cough and the mouth and nostrils are covered with mucus, greyish or yellowish in colour, and often tinged with blood. The bird has no appetite, is thirsty and suffers from constipation. If the side of the bird (with the wing raised) is placed to the ear, a sound will be heard similar to that when the finger is rubbed over plush.

Post-mortem Appearances.—After death the lungs, instead of the normal pale pink or salmon colour, will be dark, engorged with blood and solidified; there may be also blood in the bronchi and trachea. When blood is found in the two latter organs, the form is bronchopneumonia; in this case the lung is not so solidified. In croupous pneumonia the lung is much more solidified, and a piece of it, if dropped into water, will sink, whereas healthy lung tissue will float.

Treatment.—The bird should be kept in a warm room, free from damp, cold and draughts, but with plenty of fresh air. Linseed tea should be given in small quantities and frequently; in it put a little nitrate of potash, sufficient to enable the bird to have one grain three times a day. When the bird begins to get better, give one grain of quinine or ten drops of cod liver oil once a day. The food should consist of bread and milk, milk to drink, an egg beaten up and a little raw meat.

Prevention.—Keep the birds from exposure to cold, particularly when it is wet. Avoid damp, stuffy houses, and do not give too much food of a fatty and starchy nature. The birds should have plenty of scratching exercise, fresh air and green food.

Bronchitis.—This is a disease which is fairly common among fowls, especially during the wet weather. It is inflammation of the mucous membrane of the trachea and bronchial tubes.

Cause.—Exposure to damp, cold, draughts and sudden and extreme changes of temperature. Therefore it is more common in this country at the beginning of the wet season than at any other time.

Symptoms.—Dulness, loss of appetite, cough, laboured breathing. If the side of the bird, with the wing raised, is placed close to the ear, a blowing, whistling, rattling or bubbling sound will be heard.

Post-mortem Appearances.—Mucus of a bubbly nature will be found in the air passages, and the surface of these will be inflamed. The lung will be slightly darker than the normal salmon pink colour.

Treatment.—The bird should be placed in a dry, fairly warm place free from draughts, but with good ventilation. Again, as in pneumonia, give linseed tea, or honey mixed with warm water; give also three to six drops of either syrup or wine of ipecacuanha once a day. Feed as recommended in pneumonia.

The Congo Market.

The possibilities of the Congo as a market for products grown by the farmers of Southern Rhodesia deserve much greater attention than they have as yet received from our producers and middlemen alike. Two fundamental facts are obvious: first, that, save for Northern Rhodesia, this country possesses exceptional geographical advantages over the rest of the world in serving the great and growing Katanga market; secondly, that we are in a position to provide certain requirements which cannot be grown nearer, neither within the country nor in the neighbouring territory of Northern Rhodesia, at any rate as yet, or in adequate quantity.

It should, therefore, be possible to dispose of certain of our surplus commodities to the advantage both of the consumer in Katanga and of the producer in Southern Rhodesia. We benefit in obtaining a market nearer than any other, and the consumer in the Congo has less freight to pay and can obtain his perishables in a better and more fresh condition. Only Northern Rhodesia can meet the demand to better advantage in respect of distance, but our farmers have the advantage generally of producing on a larger scale, of greater organisation, and of being in a country of more economic development, rendering the cost of production in many ways cheaper. These advantages must be shared with the consumer, so as to ensure full and permanent benefit therefrom.

Hitherto this advantageous position has been largely neglected, to the loss of both communities involved through some lack of initiative on the part of those desiring to sell and to buy in the respective countries. The trade has, therefore, been left to the more enterprising commercial man in the Union, and, so far as he can meet it, to the nearer supplier in Northern Rhodesia. Southern Rhodesia can only secure markets by under-selling her rivals or by giving better value in one form or another. Northern Rhodesia, whilst enjoying the natural advantages of the situation, is not as yet able wholly to supply the needs of the Congo, and can therefore raise no objection to others furnishing what she herself cannot provide. If price and quality are right, it is only this difference between the Congo's needs and what Northern Rhodesia can provide that can be supplied from further south.

For the benefit of the community there, the Administration of our northern "half-section" has been actively endeavouring to develop the markets of the Congo to the mutual advantage of the mines of the Katanga and the farmers of the territory. To this end Mr. J. C. de Jocelyn de Jong, Secretary for Agriculture, has visited Katanga with the object of studying the position there and endeavouring to develop markets for the products of Northern Rhodesia. It is recognised that high prices in the past have not only discouraged trade between

Katanga and Northern Rhodesia, but have diverted it and turned the attention of buyers to other sources of supply. As substitutes for maize, cassava is obtained from more tropical regions, and which of these two articles will be consumed and preferred depends on the prices of each delivered at the mines. Ground nuts and beans are imported in fairly large and increasing quantities from equatorial Africa, and, owing to the present high price of maize, these foodstuffs are added in increased ratios to the native rations, thus to some extent replacing Northern Rhodesian maize in the Congo.

Southern Rhodesia does not look to the Congo as a maize market, since this grain can undoubtedly be more advantageously supplied from north of the Zambesi, but it has occurred in the past that maize has been sent up from the Transvaal, and in such cases certainly we might expect to be better able to supply it from here. Such an occurrence must in any case only be exceptional, and it is regularly recurrent trade that helps the farmer, not such spasmodic deals. The same remarks apply in regard to maize meal. The truth holds that even in the remote Congo the price of maize from near-by sources is influenced by the world's market price, by the demand in Europe, and the price of the season's crop in South America or the Danubian States must influence the rate obtainable in Central Africa. Without certainty of markets, crops cannot be sown, although the converse is just as true, that without assurance of sufficient and regular supplies, there can be no fixed demand and no stable trade, as somewhat bitter experience in the past has shown.

The requirements of the Congo for potatoes and onions ought to be easy for merchants here to ascertain, and should not be liable to much fluctuation. A certain quantity of potatoes is imported from Northern Rhodesia, but large consignments are received from the Union. If our farmers could be assured of a steady sale at reasonable prices, supplies would be forthcoming. It is the uncertainty of the demand which results in a corresponding irregularity in supplies and hence to an erratic trade, partly from this country and partly from the Transvaal. If some constancy in the trade could be relied on and if its magnitude could be forecasted, these crops might be all grown in Southern Rhodesia in sufficient quantity to meet the Congo needs. The consumer and producer would then share the advantages of a comparatively short railway haulage. Only a limited amount of these crops has as yet been produced in Northern Rhodesia.

In the same way Southern Rhodesian oranges have a considerable advantage over those from the Union, and since they can be sent successfully to England and the Continent, they can surely arrive at the Congo in as good order as they do at Capetown. There is a decided and good demand for fruit of all kinds, especially oranges.

As regards wheat, we have still far to go before we supply entirely our own needs, but when that is the case any surplus can go north. Northern Rhodesia also is not able to supply her own needs and those of the Congo, though the production of this crop is, we are glad to say, progressing so well that active steps are being taken to erect a flour mill at Lusaka next year.

Dairy products to a large industrial community in a tsetse fly-infested country ought to offer singular attractions to a community admittedly anxious for the monthly cheque that a creamery can furnish, or the pin money that comes from the churn and goes not on pins, but on wages and household bills. It is satisfactory to find that most of the butter consumed in the Congo goes from Gwelo. The types of cheese made in Rhodesia, chiefly cheddar and sweet milk, are not the kind readily eaten by the Belgians, and it would be well for farmers wishing to develop this line to turn their attention to the soft—hence wet and profitable—classes of cheese in demand there, and to supply what is wanted.

For eggs there is a regular demand amounting, according to recent returns, to about 140,000 a month, of which two-thirds come from the Union and only one-third from Southern Rhodesia. In this case, freshness being an important factor, as well as distance and railway charges, surely there is an opening for the new egg circles and for traders who take farm eggs from customers "on account." The supply of butter and eggs from Northern Rhodesia to the Congo is insufficient to meet the demand.

The principal perishable product required in the Belgian Congo is beef, and this cannot at present be fully provided from Northern Rhodesia, whilst Barotseland is indefinitely closed on account of pleuro-pneumonia. Ngamiland has only furnished limited quantities so far, and there are obvious objections to this traffic. Cattle from Angolaland are already being sent in small quantities to the most western of the mines, and should the railway between Benguella and Elizabethville ever become an accomplished fact, and the difficulties due to tsetse fly thereby be circumvented, then, in spite of pleuro-pneumonia and other diseases, no doubt the cattle of Portuguese West Africa will be able to reach Katanga. This contingency is not, however, an immediately pressing one. Proposals were recently considered, although no actual steps are yet being taken, to bring cattle from the Ruanda district down Lake Tanganyika to Albertville to a freezing works to be established there, and thence to Kabalo and Bukama by railways which are to be built. The most feasible possibility, however, remains of the conveyance of cattle or beef in frozen form over the existing railway from Southern Rhodesia. After prolonged deliberation and negotiation, it has been arranged that, subject to many stringent provisions, all tending to restrict the business, live cattle may be sent from Southern Rhodesia to the Congo during certain months of the year, but the limitations imposed are so severe that it would undoubtedly be preferable to send frozen beef instead of live stock, and no doubt this will be done as soon as the necessary refrigeration facilities can be provided. Northern Rhodesia will always retain the enormous advantage to which she is entitled by her position of sending stock alive to the north for slaughter there.

While on this topic it is well to point out that in the Congo there is a demand, if a limited one, still deserving of consideration, for breeding stock, particularly cows and bulls of milk breeds, which might be developed to mutual advantage. Moreover, there are occasional

enquiries for boars and sows, as well as a constant demand for fat porkers for immediate consumption, and for superior poultry and settings of eggs, all of which can surely be supplied more advantageously from Southern Rhodesia than from further south. So far as Northern Rhodesia for any reasons fails to meet the needs of the Congo in part or whole, as with cattle, pigs, sheep, goats, bacon, potatoes, onions, oranges, butter, cheese and other lines, there Southern Rhodesia is in the next most favourable position to supply these needs, and may through other circumstances be able to do business on even better terms to the consumers. The market is ample for both territories. Certainly there seems no adequate reason why business should go past us to the south in those cases where our production suffices to meet the demand, and there are striking instances where a reliable demand exists, which we ought already to be meeting in full, but are not doing so, as, for example, in the case of eggs. Quality will ever remain a factor outweighing distance and price, and it is to be remembered that the market is a discriminating European one, in which a good reputation is essential and where fair dealing will establish permanent good relations and where the reverse is not forgotten. The best practical way of securing and ensuring stability of trade is by means of the forward contract, a definite agreement, that is, to buy at fixed prices over a prolonged period. It gives assurance to both sides, and only requires reasonable safeguards and elasticity to make it a sound and workable system. The buyers welcome a supply sure within limits, and the farmer realises that he can go ahead with some certainty of selling the crop he plants or the produce he raises.

So far as Southern Rhodesia is concerned then, there appears to be room for a much larger export trade to the Congo than yet exists. With the above examples before us it should not be difficult greatly to extend our present very limited trade, and to develop it along lines calculated less for immediate high profits than for the establishment of lasting commercial relations, to win the market and to hold it, and so to be assured of a ready and reliable outlet for whatever we can produce.

Swamp or Irrigated Rice.

The following interesting notes on rice growing in India, kindly prepared by Mr. K. V. Joshi, B.Ag., Rice Specialist to the Government of Bombay, have been forwarded to us by Mr. C. H. Horden.

Rice should have a hard transparent grain, long and fairly broad, and be capable of receiving a good polish. The short thin grain has no market among Europeans. The soft and opaque grain is also not much in demand among them for food purposes. These kinds are usually exported to Europe for starch-making and the distillation of spirit.

As regards the method of cultivation, most of the transparent hard grained varieties are grown by the transplanting system in the following manner:--The seed is first sown at the commencement of the rainy season (about 15th June in India) in well pulverised seed beds, manured with cow dung, ashes, green leaves, compost, sheep foldings or any other suitable manure. Oil cake, fish manure and sulphate of ammonia are also suitable, and should be applied to the seed beds in the proportion of, say, $2\frac{1}{2}$ lbs. nitrogen per 1-40th of an acre (33 feet by 33 feet). The seed beds should be watered if the rains are late or deficient.

The seedlings will be ready for transplanting in three or four weeks from germination. About 7 to 10 lbs of seed is generally required per 1-40th acre of seed bed, and an area of, say, 1-6th to 1-10th of an acre should supply sufficient seedlings for planting an acre. While the seedlings are growing in the seed beds, the field to be transplanted should be given two or three ploughings *in water* so as to prepare a puddle of good consistency.

When the seedlings are from 15 to 20 inches high in the seed beds, water is impounded in them and the seedlings are uprooted and taken in bundles to the fields for transplanting, which is done in the puddle in bunches of 10 to 12 seedlings placed about a foot apart. About three days after transplanting, the water in the fields should be reduced to $\frac{1}{4}$ inch for about a week or ten days, after which more and more is admitted and impounded as the crop grows. In draining away the water, care must be taken to see that the suspended mud has settled. The object of this operation is to allow the newly transplanted crop to aerate and establish well. The fields should be re-filled with water slowly, raising the depth to about 3 to 5 inches all over, but not more. Too much water is detrimental. It is best to change the field water as often as it can be done, if possible once a week. The water in the fields should never *at any time* be less than 3 to 5 inches deep, and should be kept at this level until about ten days before harvesting the crop.

The crop needs no other care except weeding and control of water from transplanting to harvesting. When the grain is ripe the crop is reaped and stored in bundles, and threshed according to convenience. Threshing is done either by beating the sheaves on the floor or by treading under the feet of bullocks. It is then winnowed and bagged.

If it is intended to do away with transplanting, rice can also be grown by directly drilling the seed into the fields with a 12 inch drill, but in this case the yield is likely to be less. As an alternative to transplanting, a better system is the square sowing method invented by Mr. P. G. Joshi, Superintendent, Ganeshkhind Botanical Gardens, Kirkee, Poona. In both these systems (drilling and square sowing) the fields have to be ploughed and harrowed during the previous hot weather, and the seed should be sown at the advent of the rainy season (about 15th June in India), by a 12 inch drill in the first system (drilling), and by a marker followed by the sowers in the other (square sowing), the sowing being done by hand. In the former system about 80 lbs. of seed is sown per acre; in the latter from six to eight seeds are dropped at marks 12 inches apart each way. The crop in both systems is cultivated three to four times between sowing and harvesting. The advantage of the square sowing system is that the crop can be cultivated both ways. For both these systems a lesser quantity of water would be needed, and if the rainfall in Southern Rhodesia is not adequate for swamp rice I would recommend both these systems.

In the transplanting system the object of changing the water is to aerate the roots. In the other two systems this is done by cultivating.

As regards machinery for hulling and polishing, according to my information the "Engleberg rice huller and polisher No. 3" is well suited for small concerns. It is a small and simple machine, and has both the hulling and polishing parts fitted in one case. It is worked by a 4 h.p. engine. Its capacity per hour is 70 to 80 lbs. The price of this huller and polisher is 150 dollars in U.S.A. A bigger one, No. 1, worked by a 12 h.p. engine, with a capacity of 500 lbs. per hour, costs 200 dollars. The full address of the firm is:—The Engleberg Huller Co., Syracuse, N.Y., U.S.A.

The Cattle Industry.

The alleviation of the drought by early and abundant rains was very welcome and has undoubtedly saved the lives of many thousands of cattle and put matters right for the season as regards veld and water. For this mercy let us be thankful, although the very numbers of our cattle to-day constitute a problem.

Apart from deaths owing to the drought, all stock lose condition abnormally, and to young and growing animals this is specially prejudicial. It takes an animal much more time and more food to replace flesh which has been lost than to add the same weight to a carcass already in good and thriving condition. The word "condition" implies more than mere flesh and fat. It connotes a system in good tone, with every part in a state to convert the foodstuffs eaten rapidly and economically into new tissue. The set-back of the drought will be felt over millions of cattle throughout South Africa; in Rhodesia less perhaps than in other parts, but still sufficiently in the aggregate to mean a great difference compared to what would have been the condition and the calving during the coming season had the rain been normal last year instead of ceasing three months too early.

The committee appointed by the Government to enquire into matters connected with the cattle industry held its first meeting on 8th November at Salisbury. It has a great opportunity before it, and it is earnestly to be hoped that from its deliberations there may emerge some recommendations of tangible benefit. The cattle industry of Rhodesia is in a grave predicament, and as cattle continue to increase and the prospect of markets does not improve, but rather the reverse, the position is rapidly becoming acute. A critical state of affairs is now approaching, and it is difficult to see what actual steps can be taken and by whom to alleviate the position. The Government and the cattle owners may be anxious to assist, but without adequate markets not much can be done. The views of the committee of enquiry which is charged with finding some solution will be awaited with more than ordinary interest.

It is not difficult to forecast that no single panacea will be forthcoming, also that no committee, however willing, can of itself create outlets for our cattle. Probably a variety of suggestions will be received and considered, and from these a number of separate means to alleviate the situation may be advanced. As a result of consultation perhaps means may be proposed whereby markets may be found or by which Rhodesia may be made sufficiently attractive to those able and willing to convert our cattle into products saleable to-day in the markets of the world. These inducements must, however, obviously be

material and permanent, and very likely may include prices lower than our breeders have been accustomed to place on their stock.

The collection of evidence by the committee is now in progress, and it is to be hoped that anyone in a position to afford information or make suggestions which might prove helpful will make it his duty to do so and will come forward and furnish his views to the committee. Necessarily the collection of evidence must take some time.

One matter which no doubt will receive the attention of the committee is the agreement between the Union Government and the Imperial Cold Storage Co. in respect to the establishment of freezing works at Walvis Bay to deal with the much smaller number of cattle in South-West Africa than there are in Southern Rhodesia under a system of limited monopoly which appears well adapted for this country also.

Lately a conference of all interested in the cattle industry in its various aspects, including representatives of the Government of the Union, and summoned under its auspices, was held at Pretoria. The conclave, though not a commission, was yet a gathering of a kindred nature, and very probably the discussion and decisions reached on that occasion will have something in common with the deliberations of our committee of enquiry.

A welcome event, if a minor one, is the reduction in the price of dip announced by vendors of certain of the more largely used brands. Such competition is helpful to the stock owner, on whom, at present values of cattle, the high prices charged for an article which under the law he is compelled to buy and use have been burdensome. Though there is a selection of dips to choose from, yet this commodity has the great merit as a selling line of compulsory use and might therefore well come under Government price control if ordinary commercial rivalry should fail to bring prices down in accord with the general reduction in the cost of living. It is well, therefore, that prices of dip are being cut.

Export of Cattle to the Congo.—For the information of those interested in the export of cattle from Southern Rhodesia to the Congo market, the following intimation is taken from the circular issued by the General Manager of the Congo Railways:—

“The following measures will be taken for the safeguarding of cattle imported from Rhodesia, also the cleansing and disinfecting of cattle trucks used for transporting such animals before returning them to the south.

“(1) *Precautions for Animals.*—The cattle will be unloaded at Sakania. They will be watered freely with fresh water and returned to the truck for transmission to the north. Particular attention must be paid to ‘kraal’ (?) watering places, which must be frequently cleansed.

“Poultry must also be watered at Sakania.

“(2) *Disinfection of Trucks.*—The trucks, from which all refuse has previously been removed by scraping, will be washed with plenty

of water, to which Cooper's Dip has been added in proportion of 1 per cent., and after lime-washed.

"These measures for disinfection will be carried out by the railway officials at Sakania for trucks having conveyed cattle for Sakania and Tshinsenda, and by the Elizabethville railway officials for those trucks conveying cattle to the centres of Elizabethville and the north.

"In connection with these services the following charges are made :—

15 francs for cleansing and disinfecting each truck.

10 francs per truck for watering the cattle."

Rhodesian Produce in Europe.

By J. W. DOWNIE, Manager of the Farmers' Co-op., Ltd.

Rhodesia, with its comparatively small European population and its rapidly increasing native population, is destined to be an exporting country. Already the Rhodesian farmer is producing his main crops in excess of the country's requirements, and as farmers in the south are doing exactly the same thing, we in this country must look to Europe for our markets and produce in excess of our needs only transportable crops that can be readily sold to the United Kingdom and elsewhere.

The writer was in London recently in the interests of the Farmers' Co-op., Limited, and while there took the opportunity of visiting the various markets in which Rhodesian produce was most likely to be in demand. Visits were paid to Liverpool, Manchester and Glasgow, as industrial centres, as well as the ports of Hamburg, Antwerp, Rotterdam, Amsterdam and the inland cities of Brussels and Berlin.

By means of letters of introduction previously obtained, calls were made in each town on one or more importers interested in maize, ground nuts, beans and even butter. With only one exception I found the principals and managers interested in Rhodesia and ready and willing to buy our produce, provided always the price was right, and by "right" the importer means competitive.

Maize.—Taking maize first, the best buying markets proved to be London, as a consuming and distributing centre, and Rotterdam, Antwerp and Hamburg, in the order named. Bordeaux, I learned, was also a small importer from London, but France generally is not a big buyer of white maize, and the trade routes do not favour the marketing of our products in that country. The biggest obstacle I found to the regular marketing of our white maize was the quantity produced. Not that Africa produced too much, but that it produced too little.

The starch manufacturer, the manufacturer of corn flour and the distillers have already shown their preference for our white maize, and in seasons of scarcity are prepared to pay a premium as against yellow for their needs, but their needs are small and do not mean very much to us if our production is to increase.

The big millers in England have somewhat of a prejudice against white maize, and the senior representative of one of the largest distributors of maize products told me that his firm only purchased white maize when they could get it at a slight discount as against yellow. In the course of conversation I learned that this was not due to any defect in the white maize itself, but simply by reason of the fact that the majority of the users of maize and maize products in England had been using yellow for years, and could always get it, and were therefore offered no inducement to make a change from yellow to white. In other words, the using of yellow as against white is very largely custom. In addition to this there was a prejudice against using a product which could not be obtained in and out of season, and this objection is one which can only be remedied by an increased production in Rhodesia and South Africa generally.

In Hamburg and Antwerp I found that there was a steady demand for our white maize for industrial and feeding purposes, while in Rotterdam the demand was generally on behalf of dairymen and for use in Germany for industrial purposes, and to some extent for ordinary domestic consumption when mixed with grain of their own production. The Dutch farmer in Holland houses his dairy cattle for the larger portion of the year, and the consumption of maize in that country as a cattle food must exceed the total average export from South Africa. White maize is finding favour with the dairy farmer as a cattle food, but the objection raised by the distributors in Rotterdam and in Amsterdam is that they are unable to get regular supplies, and they found that their customers did not like being compelled to change from white maize to yellow and again from yellow to white. The softer nature of the grain appeared to me to be the Dutch farmer's reason for preferring the white maize to the yellow. This particular market is one which I feel that we should do well to develop in the future.

In all the continental towns I visited, particularly Hamburg and Berlin, I found that there was a desire to try and avoid London as a buying centre, and there was a general desire to do business direct with South Africa. This desire was not due to any dislike of London business methods, but simply because importers seemed to think that

if they could do business direct they would be able to buy at better rates than they could through London. From the point of view of the seller, this is not strictly correct, because the seller as well as the buyer is always out to get the best price, and usually chooses one competitive centre on which to base his quotations. In addition to that, the exchange position on the Continent is such that it is necessary for the South African exporter to choose a point as near the buying market as possible from which to negotiate, so that close attention can be given to his drafts in case of need.

Maize Meal.—The demand which sprang up during the war for maize meal is not one that is likely to continue as we return to times of peace and ordinary trading. The war demand was largely due to the fact that many mills were put out of commission or were employed on war work, and cattle foods were being handled through Government sources, and the economic laws of supply and demand did not obtain.

The shipment of maize meal from this country is not likely to prove profitable except when shipped on a contract first made. The market for meal is a limited one, and the varied uses to which whole maize can be put often place it at a premium over the ground product.

Much can still be done in Europe to popularise the use of white maize, but it is doubtful if any good purpose can be served by doing so until there is a considerable increase in the quantity available for export.

With the aid of a letter of introduction from the Rhodesian Department of Agriculture, I was able to interest not only the Director of the Imperial Institute, but also one of the principal officials at the Ministry of Agriculture and Fisheries, and these gentlemen were prepared to assist in inaugurating feeding trials of white maize at certain of the schools of agriculture under their direction. These feeding trials, if carried out, will naturally extend over a considerable period, and the results should prove of interest not only to agriculturists in the United Kingdom, but also to the growers here. In all my enquiries I was in close touch with the Union Government's Trade Commissioner, and Mr. Canham kindly promised to follow up my enquiries, particularly in regard to the feeding trials, and I have no doubt that when they are complete Mr. Canham will communicate the results to us in this country.

One incident, as indicating the somewhat watertight compartments in which the Government works at Home, is worth relating. In conversation with one of the principal officials at the Ministry of Agriculture and Fisheries, I suggested that something might be done to help Empire producers, and particularly Rhodesian and South African maize growers, by getting the sympathy of those departments which were buyers of maize for feeding purposes. My friend, after a moment's thought, said that the War Office was probably the largest consumer, but that if his department were to make any suggestion as to the food used by War Office animals he would probably be told to go to —. His opinion was that the Colonial Office was the best medium through which to make any suggestion, and if repre-

sentations were made by the country concerned to the Colonial Office there was no reason why it should not have the desired effect. I repeat this suggestion for what it is worth.

This is probably the best place in which to state that the Rhodesian farmer or the South African farmer is likely to find that when it comes to the marketing of his produce, his best friend is himself; in other words, I want to emphasise that as production of white maize increases, the South African farmer must make it his business to have his own representative in Europe, independent of but in addition to the usual Government representative or Trades Commissioner. As a result of my experience I have come to the conclusion that frequent visits of South African representatives to Europe are likely to prove of much more value than the appointment of any permanent representative, and particularly the appointment of a man not conversant with Rhodesia or South Africa. So much more interest is taken in a stranger from abroad than is taken in a Londoner who calls representing the overseas producer.

Ground Nuts.—I have already explained elsewhere that during the last ten years there has been a tremendous increase in the demand in the United Kingdom for ground nuts as an oil seed, and that in my opinion this is a crop which it would be possible to grow in this country to advantage.

In comparing this country with Nigeria, which is one of the countries which has shown a very rapid expansion in its production of ground nuts, I take the view that the conditions are very similar to those obtaining in this country, and that from the point of view of marketing we suffer no serious disabilities. The districts in which the ground nuts are produced there are at a greater distance from the port than our farmers are here. The rates for their produce are, if anything, in excess of the rates charged by the Rhodesian Railways, and freight at the time of my visit was within 2s. 6d. per ton of that charged from Beira. True, the nuts grown in Nigeria are produced by the native, but they pass through the hands of two or three traders before reaching the oil mills in the United Kingdom, and I make bold to suggest that with the superior intelligence that can be brought to bear on the growing of the crop by our Rhodesian farmers, it should be possible to compete.

The advantage of the ground nut as an auxiliary to the main crop is that they are not both governed by the same conditions, and a depressed maize market does not by any means mean a depressed market for oil or oil seeds. The question of the production per acre is one which must be left to the expert and to experience. My company at present is endeavouring to find suitable machinery for harvesting and for decorticating the nuts—and as far as decorticating is concerned, I think we are within sight of success.

Sunflower Seed.—This is a crop which I have also indicated as in demand in England, provided it can be produced at a profit on the basis of its oil content. Its demand in the markets for purposes other than oil is very small, but there is an unlimited demand provided

we can produce the seed and deliver it in London at a price round about £10 per ton. The view has been expressed in regard to ground nuts and also to sunflower seed that, if our Rhodesian farmers would give the same close attention to these two crops as they do to the maize crop, the yield per acre could probably be considerably increased.

Beans.—The market in Europe for beans is as a cattle food only. The Rhodesian farmer cannot expect to compete with the European peasant on a small holding who is within reach of the market and can gauge the demand and public taste much better than we can do at this distance. Beans as a cattle food vary from £8 to £12 per ton, and I am afraid that no profit can be obtained from their production except as a result of their value as a rotation crop, and not on account of their market prices.

Butter.—At the time of my visit prices for butter were very low, but have since considerably improved, and I see no reason to think that they are likely to go back to the prices which were reached in January and February of this year. There is a demand in Holland as well as in the United Kingdom for butter, and firms I called upon at Rotterdam were only too anxious to open up business relations with exporters in this country.

One word of advice I should like to give the Rhodesian farmer, and that is that as far as Europe is concerned the buyer is out to get *quality*; only the best is good enough, and if we are to enter into competition with New Zealand, Australia, Denmark, Ireland, the United States and the Argentine with the products of this country we must make it our business to see that we produce only the best, and that having produced of the best the greatest care be taken in manufacturing products which must be exported, and that having done so we see to it that we get the best selling organisations available.

Co-operative institutions in New Zealand and Australia have taken a very strong hold and are largely responsible for the success that has attended the dairy industry in these two countries, and they also to an extent have to be thanked for the success that is being attained by the wheat farmers. If the Rhodesian farmers are to succeed and to compete in the world's markets with their maize, their ground nuts, their butter and eventually their bacon, it will only be through co-operative effort. There is no room for wasted energy. There is no room for competition in the buying of their products and again for competition in the selling of their products. In other words, the Rhodesian farmers must so join hands that in the production and in the manufacturing and in the marketing of their produce overseas there must be nothing lost by competition.

The fortune and the future of the Rhodesian farmer are very largely in his own hands, and if he fails it is more likely to be from lack of cohesion than from any other cause.

Harvesting Operations at Gwebi Experiment Farm.

PRELIMINARY NOTES ON THE COST OF VARIOUS OPERATIONS AND THE TIME AND LABOUR REQUIRED TO CARRY THEM OUT.

By R. H. CARDWELL.

The following notes have been compiled from actual results and careful records kept on the Gwebi Experiment Farm during the past harvesting season, with a view to ascertaining costs and the amount of labour entailed in each operation.

Yield per acre being a dominating factor in the cost and efficiency of labour involved in harvesting, it follows that the figures arrived at for one season will not necessarily be exactly the same as for another, but the yield this year being considerably below normal, owing to the drought, it may reasonably be expected that appreciably lower costs and higher labour efficiency can be secured in an average season.

Data of this nature are always open to criticism, there being other obvious points besides yield to be taken into consideration, such as the efficiency both of supervision and of the labour itself, condition of the land in the case of crops such as ground nuts, methods employed, etc. Since, however, these notes are based on actual observation and on carefully kept labour distribution sheets, they represent, if allowances are made for the season and working conditions, a schedule of task work which may prove a useful guide when commencing the various harvesting operations, but subject always to alteration in accordance with personal observations.

The tasks given were completed in from seven to nine hours, and represent what an average native performed in an eight-hour working day. The average cost of native labour on the farm—wages and food—is estimated at 10d. per diem.

Maize.—Average yield per acre, 5.46 bags (2.2 bags cobs, 1 bag grain). Cutting stalks with cane knives and laying them on the ground in the rows preparatory to stooking.—Two acres per native per diem.

Stooking.—Two acres per native per day, working in gangs of four.

Picking and husking cobs from the stook.—This varied considerably, only 5 bags of cobs being picked and husked per native on the lowest-yielding lands, while up to 10 bags were done on sections yielding from 8 to 10 bags of grain per acre. In the first case a large number of thin barren stalks had to be handled.

Ground Nuts.—720 lbs. unshelled nuts and $\frac{1}{4}$ ton hay per acre.—Lifting of the plants was greatly hampered by the hardness of the ground, and after removal each hole had to be scraped with a short bent piece of hoop iron, so that the average task performed per native per day was only 1,080 yards of rows; under favourable conditions 1,500 yards could be done.

The plants from each two adjacent drills were laid in one row and left lying for four days. They were then heaped while the dew was still on them, four natives cocking one acre in two hours. In forming the heap, those plants nearest the ground were placed nuts uppermost.

After cocking, the loose nuts left lying on the field were gathered up, one native collecting about 75 lbs. of nuts per diem and covering about an acre to do this. Fifteen days after pulling, the nuts were picked from the plants and the cocks re-built to prevent damage to the hay. From 80 to 100 lbs. clean nuts were brought to the homestead daily by each native. The hay, which was of good colour and quality, was subsequently baled.

Velvet Bean Hay.—About 2,600 lbs. per acre.—Cut with knives and left lying *in situ*, each native reaped $\frac{3}{4}$ acre per diem. On the fifth day after cutting, the vines were rolled into small heaps, five natives doing five acres in the first two hours of the morning. All handling should be done while the dew lasts, otherwise great loss of leaf results. Five to seven days later the small heaps were collected into large cocks, five natives doing five acres of this work in about one hour.

Velvet Bean Seed.—300 lbs. per acre.—Reaping for seed after the crop was ripe, one native collected the seed from 800 to 950 yards of row per diem.

Sunflowers.—540 lbs. seed per acre.—The heads were cut off and left face upwards in small heaps on the ground, and the stalks were then severed close to the ground, each native dealing with $\frac{3}{4}$ acre of land per diem. When sufficiently dry, the heads were collected in sacks preparatory to bringing them to a central place for threshing. In this work two natives can be expected to fill about 80 bags of heads a day. The seed was rubbed off the heads by hand with a maize cob or small piece of stick, and with this method it was found that an average of one bag unwinnowed seed can easily be maintained per boy per diem. This seed was subsequently put through the winnowing machine to clean it and to blow out immature grain.

Boer Manna.—207 lbs. seed per acre.—This was cut with sickles, tied into bundles and stooked, each native in a day's work doing $\frac{1}{4}$ up to $\frac{1}{2}$ acre according to the stand. Threshing was done by hand in gangs of five boys, from 5 to 6 bags of unwinnowed grain being threshed each day, or about 1 bag per boy.

Linseed.—175 lbs. seed per acre.—Pulled and stooked, $\frac{1}{4}$ acre per native per day. Threshing and winnowing by hand, eight natives turned out one bag of clean seed in eight hours.

B.E.S. Peas.—222 lbs. seed per acre.—Cut with knives, two acres per native per day. Threshing by hand, $1\frac{1}{2}$ to 2 bags unwinnowed seed per native. Winnowing (twice) with machine, 2 to 3 bags clean seed per native.

Oats.—278 lbs. seed per acre.—Cut with sickles and stooked; $\frac{1}{4}$ acre per native. Threshed with Little Gem thresher, six natives did 30 bags unwinnowed seed per day. Eight bags unwinnowed seed produced 100 lbs. clean grain.

A Short History of the Infective Diseases

AMONGST THE DOMESTIC ANIMALS OF SOUTHERN
RHODESIA SINCE THE OCCUPATION.

(Continued.)

By J. M. SINCLAIR, M.R.C.V.S., Chief Veterinary Surgeon.

GLANDERS.

There is very little definite information regarding the existence of glanders until the year 1898, when it assumed very alarming proportions, as may be judged from the fact that, out of 400 animals tested with mallein in Matabeleland, over 25 per cent. re-acted. Infection existed at every centre in the Territory practically, and the losses amongst the mules employed on the various coach lines and the Government transport mules and Police horses were very heavy.

In January, 1899, a High Commissioner's Proclamation was promulgated which provided, *inter alia*, for the destruction of all diseased animals, the isolation of suspected cases and the application of such

tests as might be considered necessary. It also empowered the Administrator to frame rules and regulations for the better execution and administration of such Proclamation. Under the latter provision a Government Notice was promulgated in April, 1899, the most important features of which were (1) the compulsory application of the mallein test to all horses, mules and donkeys in the Territory; (2) the compulsory application of the mallein test to all horses, mules and donkeys entering the Territory; (3) the segregation, under veterinary supervision, of all animals giving a re-action to the test not considered sufficient to justify immediate destruction. The disease was so rampant in Bulawayo that special provision was made in the Government Notice referred to for dealing with it. The town was divided into three sections and a veterinary surgeon appointed to each, and to assist them in the work Messrs. Bowie, W. G. Manson and C. H. Zeederberg were gazetted as inspectors. The work of testing all animals in and entering Bulawayo, disinfecting stables, etc., was expeditiously and satisfactorily carried out, and resulted in the complete eradication of the disease and of all infection in stables, watering troughs, etc. The work of testing all animals in the Territory was steadily pursued and completed in 1900. In Matabeleland the total number of animals tested was 4,900.

Unfortunately there are no records showing the total loss from the disease, but it was very considerable. In a report by the writer for the year ending 31st March, 1900, it appears that 46 cases occurred and were destroyed, and the remark is made that the "great diminution in the number of clinical cases of glanders during the year under notice is very satisfactory."

The isolation stable established at Bulawayo for the reception of doubtful re-actors was closed in December, 1899. Most of the animals received there were eventually destroyed, a few were returned to the owners after ceasing to re-act to mallein, and in no case did glanders subsequently manifest itself.

In 1900 a serious outbreak occurred at Marandellas amongst horses belonging to the Australian contingents *en route* to Mafeking, but it was satisfactorily dealt with, without the spread of infection to local animals.

The system of testing all horses and mules on arrival in the Territory has been carried out to the present day, and has proved most satisfactory in preventing the re-introduction of infection, as the following record of disease in the Territory since that date will show. It may be stated in this connection that in testing animals on importation the local re-action has to be relied on entirely, as the long train journey, strangles, colds and other complaints, also the large number of unbroken animals, render temperature observation valueless.

During 1903 a mule at Enkeldoorn and a horse at Umtali were destroyed as glandered. All in-contacts were tested, without result. Six animals re-acted to the mallein test at ports of entrance and were destroyed.

In 1904 three glandered animals were destroyed in the Territory and four at ports of entrance, having re-acted to the mallein test.

In 1905 an outbreak occurred at the Police stables in Umtali. Two horses were destroyed and all in-contacts tested with mallein, the results being negative.

In 1906 two animals re-acting to mallein at ports of entrance were destroyed; one animal which had failed to re-act was found to be clinically affected a week later and was destroyed.

In 1909 two animals re-acting to the mallein test at ports of entrance were destroyed.

After three years' freedom from local infection, nine outbreaks occurred in 1910, distributed as follows:—Bulawayo two, Umzingwane one, Insiza one, Salisbury three and Lomagundi two. The first outbreak occurred in Bulawayo; the animal affected had been imported about five months previously, and had either failed to re-act to the mallein test or the re-action had passed unobserved. To this source no doubt all the subsequent infection may be attributed. In all, eleven clinically affected died or were destroyed. All in-contacts were tested with mallein; twelve re-acted and were destroyed.

Two outbreaks occurred during 1911—one at Gwanda and the other at Salisbury; in all, four animals were destroyed, also two in-contacts which re-acted to mallein. At the ports of entrance two animals re-acted and were destroyed.

In 1912 two animals were destroyed at ports of entrance, having re-acted to the test, and in 1913 three re-acted and were destroyed; since when there has been no case of glanders in Southern Rhodesia.

ULCEROUS LYMPHANGITIS.

In the report of the Chief Veterinary Surgeon for the year ending 31st March, 1904, the following statements appear under the heading of "Epizootic Lymphangitis":—

"In Rhodesia, the closure of the Umtali district, where the disease has been endemic for several years, has prevented any extension of the disease from that locality. The compulsory dipping of all veld-fed animals grazing on the Umtali Commonage began last year, and this step, with the systematic quarantine of infected animals, has led to a marked reduction in the number of cases of this disease in that neighbourhood during the past twelve months.

"In a recent report, the Government Veterinary Surgeon at Umtali shows that the situation now compares most favourably with the situation in 1901. He says: 'In 1901 there were, in all, 120 equines in the Umtali district, and of these 21 were in quarantine for epizootic lymphangitis, that is to say, one-sixth of the total number were affected; while at the end of 1903 the number of equines had risen to 758, and of these only three are infected, or less than one-half per cent.'

"From this it will be seen that, with appropriate treatment and quarantining, the disease can not only be checked, but there is every hope that we may ultimately succeed in stamping it out.

"In other parts of Rhodesia the disease was unknown until a few weeks ago, when five cases were found in Bulawayo, amongst animals recently brought up by rail. An examination of all solipeds in town was at once instituted by the veterinary staff, with the result that two more horses and two donkeys were destroyed, with the consent of their owners. Two mules were shot by the Veterinary Department under powers conferred by the Animals Diseases Ordinance, and at the present moment there are only three slightly infected animals in quarantine undergoing treatment."

The veterinary officer then in charge of the Umtali and adjoining districts, Mr. E. M. Jarvis, F.R.C.V.S., held strongly to the view that the disease was not epizootic lymphangitis, and that it was transmitted almost entirely by the bont tick (*Amblyomma variegatum*). In the *Veterinary Journal*, 1918, Mr. Jarvis describes at length, under the heading of "Ixodic Lymphangitis," a disease which was prevalent during the East African campaign and known in British East Africa (Kenya Colony) as ulcerous lymphangitis, and with an experience of over 1,000 cases there he had no hesitation in saying that it was exactly the same affection as that dealt with by him in the Umtali district. It is unnecessary to discuss the question at length here, but after a careful consideration of all the evidence available, the writer has come to the conclusion that the Umtali disease, known locally as pyæmia, was ulcerous lymphangitis, and that epizootic lymphangitis was a later importation. For the purposes of this history, therefore, the diseases are separately dealt with.

It is evident from the extracts quoted above that the disease had existed in Umtali for several years and had caused considerable losses amongst equines. In 1902 regulations were enacted which enabled the Department to control movements of horses, mules and donkeys, and to deal with infected animals. In 1903 provision was made for the dipping of all veld-fed animals on the Melsetter and Umtali Commonages once every twenty-one days in the regulation cattle dip. These measures resulted in the eradication of all infection in 1905, since when we have not had a single case of ulcerous lymphangitis.

Since writing the above the following interesting history of this disease in the Umtali district has been received from Mr. T. B. Hulley, formerly Native Commissioner and Superintendent of Natives:—

"In 1897 there were no Veterinary Surgeons in Umtali, and the Native Commissioner was *ex officio* Cattle Inspector. Transport rates were very high, rinderpest having carried off all transport oxen as well as most breeding stock. The Manica Trading Company, in order to overcome the transport difficulty, imported a ship load of mules from Monte Video. On their arrival in Umtali I was naturally interested and inspected them. I found a certain number suffering from abscesses in various stages, whilst others were suffering from swollen glands on

the breast and inside the hind legs. To my unprofessional mind it appeared to be farcy. I accordingly placed the whole lot in quarantine and reported the matter to the Chief Veterinary Surgeon. I cannot now remember whether he came down himself or not, but Veterinary Surgeon O'Neill came later. The disease spread to local animals and carried off practically all the horses. In 1901 Veterinary Surgeon Jarvis relieved Mr. O'Neill, and in the course of his investigations proved that the disease was carried by a tick. All animals grazing on the Umtali and Penhalonga Commonages were dipped every seven days, with the result that in a very short time the commonages mentioned were practically free from infection.

"I do not know whether this disease, as such, attacks human beings and non-equines. There was the case of a man in Umtali who had a favourite pony which he tried hard to save; whether he contracted pyæmia or a form of blood poisoning I cannot say, but he left for Durban suffering from pyæmia and died at Delagoa Bay.

"I am perfectly sure there was no pyæmia in Umtali before the importation of the mules by the Manica Trading Company. I had kept three horses for a long time, and all subsequently died from pyæmia."

EPIZOOTIC LYMPHANGITIS.

This disease was unknown in Southern Rhodesia until the beginning of 1904, when it was discovered amongst a lot of horses imported from the south; five animals were found to be suffering from it. An examination of all the horses, mules and donkeys in and around Bulawayo was immediately undertaken, with the result that two horses, two mules and four donkeys were found to be affected. All the diseased animals were destroyed except three slightly affected; these were isolated and submitted to treatment, with apparently successful results. In Gwelo one case was discovered; the animal was isolated, and it was ultimately released as cured. During the year 1905 cases occurred at various centres, but particulars are not now available. During the following year fourteen cases occurred in Salisbury, one in Gwelo, and in Bulawayo seven diseased mules were found in a consignment from the Transvaal. At this stage it was decided to discontinue the practice of isolating and treating cases showing slight lesions, and all animals, however slight the manifestation of infection, were destroyed. The soundness of this policy was justified, as no further cases occurred until 1919, when an outbreak occurred amongst a large number of mules at the Citrus Estate, Mazoe. The diseased animals, five in number, were destroyed, and every precaution taken to prevent the spread of infection, with successful results. This outbreak was most extraordinary, in that none of the diseased animals had been imported recently; in fact, they had all been working on the estate for some years, and the one in which the disease first manifested itself was an old animal known to have been in contact with infection in Bulawayo twelve years previously.

The system of inspection of horses, mules and donkeys on importation, necessitated by the compulsory application of the mallein test, is of great assistance in preventing the introduction of this disease.

RABIES.

The following description of the history of rabies in Southern Rhodesia is taken from the "Diseases of Animals in South Africa," by Mr. C. R. Edmonds, M.R.C.V.S., Assistant Chief Veterinary Surgeon, Bulawayo:

"In August, 1902, the disease appeared near Bulawayo, and was diagnosed by the writer. Considerable incredulity existed for some time amongst the European portion of the population as to the nature of the disease, but it was not so with the natives; the old men amongst the Matabele stated that the disease was prevalent in the country in their younger days, but eventually disappeared. The natives living in the vicinity of Umtali likewise confirmed a previous existence of the disease in that part of the Territory.

"There is but little doubt that the disease was introduced into Southern Rhodesia from some place north of the Zambesi River. At that time communication and traffic by road was opening up to a considerable extent between Southern and North-Western Rhodesia, and according to reports of travellers the disease was present to a great extent in the latter territory. It was stated that King Lewanika, of the Barotse tribe, before his departure for England to attend the coronation of His Majesty King Edward VII., gave instructions that owing to the existence of rabies all the dogs belonging to his people were to be killed. This may sound rather a drastic measure to take, but to eradicate rabies in any country requires drastic measures; and in uncivilised countries the task may appear absolutely hopeless, except by what may amount to the practical annihilation of the dog population, and even when that is done the wild carnivora are left to carry on the disease.

"In Southern Rhodesia the problem presented by the outbreak of the disease was a most difficult one. At that time there were no restrictions on the number of dogs in the shape of a dog tax or in any other way, consequently the country was full of all descriptions of dogs, amongst which were an innumerable number of ownerless curs that roamed town and country as they willed. To rid the land of these unfortunate and unwelcome animals the police were provided with shot guns, after the necessary authority to deal with the disease had been obtained and regulations promulgated for doing so. On 22nd November, 1902, less than three months after the recognition of the disease, the police reported the destruction in Bulawayo and the surrounding districts of 9,483 dogs, of which thirty-two were visibly affected with the disease, and that fourteen persons and in two instances 'several' persons had been bitten. The 'several' referred to natives, where it was impossible to obtain reliable information as to numbers.

"By the end of March, 1903, the number of stray dogs destroyed was 29,500 in Matabeleland and 8,759 in Mashonaland. Up to the end of March, 1904, the number of dogs put to death for non-compliance with the muzzling regulations totalled 60,000. A great number of dogs were also killed by civilians and natives that were not recorded. It is impossible to estimate the total number destroyed, but the foregoing figures give an idea of the nature of the task of eradicating the disease.

"In September, 1902, the Administration of Southern Rhodesia arranged for Dr. A. Loir, of the Pasteur Institute, Paris, to proceed to Rhodesia, where he arrived early in October, and immediately upon arrival commenced treatment, with material that he had brought from Europe, of five persons who had been bitten by rabid animals. At the same time Dr. Loir commenced the establishment of a Pasteur Institute locally, where the necessary material (brain) for inoculation could be prepared and people treated, also the training of medical and veterinary assistants to conduct the institute after his departure.

"With regard to diagnosis of the disease, amongst the earliest cases of rabies that occurred was that of a dog upon which a *post-mortem* examination was held by Dr. Hutcheon, Capetown; Dr. W. Robertson, Grahamstown, both of whom happened to be in Bulawayo at the time; Mr. C. E. Gray, at that time in the Rhodesian Service, now Principal Veterinary Officer of the Union; and the writer. From the history of the case and the *post-mortem* appearances, particularly the stomach contents, our united opinion was that it was a case of rabies. This dog had bitten a horse on the nose, which latter animal the writer took to his stable for observation. By the twenty-sixth day the animal developed furious rabies, and was destroyed for humane reasons, because it became dangerous to approach. From the brain of the horse the writer and Dr. W. G. Clark experimentally inoculated three rabbits. Three weeks after inoculation, on 20th October, one of these rabbits showing the typical paralytic symptoms of rabies was handed to Dr. Loir; from this animal and the history of the sequence of cases Dr. Loir was enabled to arrive at a decision confirming without any further doubt the existence of rabies. The disease radiated out from Bulawayo in all directions. The Transvaal Government took all possible precautions to prevent the disease travelling south, including the clearing of all its canine population from a belt of country along the Rhodesian border fifty miles wide, and also taking other preventive measures. The disease did not cross into the Transvaal, and the other States in South Africa owe a debt of gratitude to the Transvaal for the precautions taken.

"The trend of the disease was more noticeable in an easterly direction, and in the course of some months it reached the eastern border at Umtali.

"As the dog population decreased in number and became under better control, so the incidence of the disease likewise decreased; but recrudescences and single cases continued to occur until August, 1913, when the last known case of the disease in Southern Rhodesia occurred in Salisbury. Therefore the disease existed in the Territory exactly eleven years."

It may be noted, however, that in 1909 muzzling was abandoned, and regulations promulgated which provided that all dogs within a suspected infected area should be kept within a safe enclosure or chained up for a period of not less than six weeks. This procedure proved more satisfactory in every way, as there could be no excuse for a dog being at large; whereas, with muzzling, the muzzle was frequently tied round the dog's neck or so fixed that the dog could easily tear it off.

(End.)

Report of Southern Rhodesia Egg-Laying Test.

1ST APRIL TO 10TH NOVEMBER, 1922.

During the four weeks 14th October to 10th November inclusive, 88 birds were laying, and produced 1,123 eggs, an average per bird of 12.76 eggs; 24 of the heavy breed section have been laying, and have produced 262 eggs, an average per bird of 10.92 eggs; 64 of the light breed section have been laying, and have produced 861 eggs, an average per bird of 13.45 eggs.

The total weight of eggs in the four weeks was 147 lbs. 9 10-16 ounces. The maximum number of eggs laid on one day was 52 on the 8th of November, and the minimum 27 on the 15th of October. The average number of eggs laid per day was 40.10 eggs.

Of the trap-nested birds, the following laid:—

21 eggs—Pen 15, No. 21.

20 eggs—Pen 10, No. 48; pen 18, No. 87.

19 eggs—Pen 3, No. 12; pen 6, No. 26; pen 14, No. 66.

18 eggs—Pen 12, No. 60; pen 16, No. 78.

The following birds have been broody and cured:—Pen 2, No. 9; pen 3, Nos. 11 and 14; pen 4, Nos. 18 and 19; pen 5, No. 24; pen 6, Nos. 28 and 29. The following are still broody: Pen 2, Nos. 7 and 10; pen 3, No. 12.

There has been heavy rain on several days and nights during the period, during which the birds were confined to their houses.

There has been more sickness among the birds during this period than during any previous one. This is probably due to the sudden change from hot dry weather to wet weather; sudden changes always affect fowls, and find out the weak spots. There have been four deaths, all connected with the reproductive system.

One bird in each of pens 1, 11 and 13 died from peritonitis following rupture of an ovum, and one bird in pen 18 from metritis (inflammation of the oviduct) and septicæmia. Those in pens 1, 11 and 13 died on the 16th, 20th and 14th respectively, and that in pen 18 on the 29th—it had a mass of decayed egg matter in the oviduct.

No. 15 in pen 3 was ill for several days with bronchitis, but has recovered.

One bird in pen 16 is suffering from peritonitis following rupture of ovum, and is still under treatment, and one in pen 20, stung by an insect in the throat, is suffering from septicæmia and is under treatment.

About 75 per cent. of the *post-mortems* of birds sent for this purpose from different parts of the country show cause of death as due to peritonitis following a ruptured ovum. There is no doubt that heavy laying has a tendency to weaken the reproductive organs, and Nature thus retaliates for the strain incurred; it is a further proof that, to produce a strain of heavy layers, strength, vigour, stamina and health are a *sine qua non*, as well as heavy laying when the breeding birds are selected.

The bird in pen 1 has not been replaced, therefore there are only 99 birds on the test now.

Sand fleas have again been troublesome among the birds, and frequent individual treatment and spraying and disinfecting of the houses have been necessary to get rid of this pest.

HINTS FOR BREEDERS.

Keep only the Best.—The changeable and wet weather will find out those birds that lack stamina and vigour, as also will the moult which some birds are commencing now. Any that are thus affected should be marked and on no account bred from next season, however good they are as layers. A bird that cannot stand the strain of moulting or changes in the weather without deteriorating in health is really not worth keeping. Unfortunately there are some such on the test.

Selecting Birds for a Laying Test.—When choosing birds for a laying test, the greatest possible care should be taken in selection. No bird that shows the slightest weakness in any way, and no bird that does not show the points of a particularly good layer, should be included; the record and pedigree of the parents too should be carefully noted, for one bird in the pen that is not good will, of course, let down the whole pen as far as records go.

The selection of pullets for a test should commence two months before they are to be despatched, and the poorer ones gradually eliminated till the owner is certain he has selected the best layers and most vigorous birds he has on his place. It is only by following this method that he will be sure of any measure of success.

Sand Fleas.—These insects have been very troublesome this season; chiefly due to the fact that the hot, dry, dusty weather has been conducive to their increase. Once they gain access to a fowl run or house, it is most difficult to get rid of them; to do so requires perseverance and much time and labour. They are more troublesome if the floor of the house consists of loose earth or sand, for they lay their eggs about 1½ to 2 inches below the surface of this or in any interstices, as, for instance, between bricks or cracks in a hard floor. It is, therefore, useless treat-

ing the heads of the birds by application of an insecticide without treating the floor.

The best preventative is a hard, smooth floor in the house, and hard, smooth ground around the house; this should be sprayed occasionally with hot water and a disinfectant. If the fleas are present, each bird should be treated individually by applying some insecticide ointment to the heads daily, all the litter on the floor of the house taken out and burnt, and the floor and round about the house well saturated with a disinfectant and hot water, and the walls, roof, perches and nest boxes well sprayed with the same solution

No stables, pig sties, kraals or boys' huts should be in close proximity to the fowl house, for these are the usual sources from which the fleas spread.

Birds troubled with fleas naturally (due to the constant irritation they are subjected to) do not lay as well as they otherwise would, and furthermore their vitality is lowered and their health affected.

THE THIRD SOUTHERN RHODESIA EGG-LAYING TEST.
1st APRIL, 1922, TO 2ND MARCH, 1923.
HEAVY BREED SECTION.
FIVE BIRDS IN EACH PEN.

Pen No.	Position.	Owner.	Residence.	Breed.	Results from 1st April to 10th November, inclusive.		
					Total No. of eggs.	Total weight of eggs.	
					2 ozs. and over.	2 ozs. and over.	Under 2 ozs.
1	2	Mrs. Watson	Glendale	Rhode Island Reds	507	66 lbs.	5 lbs. 10 11-16 ozs.
2	3	Mrs. Bernard	Headlands	do.	464	62 lbs.	9 lbs. 11 15-16 ozs.
3	5	T. A. Stokes	Salisbury	White Wyandottes	402	52 lbs.	1 lb. 9 14-16 ozs.
4	6	Mrs. Cheesman	Umvuma	Rhode Island Reds	322	41 lbs.	10 lbs. 0 14-15 ozs.
5	1	Mrs. Colborne	Banket	Black Orpingtons...	593	79 lbs.	3 lbs. 10 11-16 ozs.
6	4	Mrs. Skillen	Salisbury	Rhode Island Reds	398	53 lbs.	0 lbs. 7 10-16 ozs.
Totals					2,686	355 lbs.	31 lbs. 3 11-16 ozs.

LIGHT BREED SECTION.

7	5	Mrs. Hatton	Umvuma	White Leghorns	452	59 lbs.	6 lbs. 9 15-16 ozs.
8	4	Mrs. Graham	Avondale	do.	475	66 lbs.	1 lb. 10 9-16 ozs.
9	11	Mrs. Hunter	Glendale	do.	409	53 lbs.	7 lbs. 8 3-16 ozs.
10	9	Mrs. Colborne	Banket	do.	439	54 lbs.	22 lbs. 5 13-16 ozs.
11	10	Mrs. Watson	Glendale	do.	409	54 lbs.	16 lbs. 4 15-16 ozs.
12	6	J. Knighton	Bulawayo	do.	440	58 lbs.	7 lbs. 5 4-16 ozs.
13	13	J. Cook	Cape Town	do.	355	45 lbs.	11 lbs. 11 7-16 ozs.
14	2	Weymouth Py. Fm.	Bulawayo	do.	529	68 lbs.	11 lbs. 12 6-16 ozs.
15	1	Mrs. Michell	Salisbury	do.	615	79 lbs.	3 lbs. 6 15-16 ozs.
16	8	E. C. Holmes	Bindura	do.	448	56 lbs.	16 lbs. 8 7-16 ozs.
17	12	Miss Greig	Bulawayo	do.	348	45 lbs.	17 lbs. 3 11-16 ozs.
18	14	Mrs. Matheson	Gatooma	do.	314	40 lbs.	16 lbs. 2 1-16 ozs.
19	7	Mrs. Russell	Que Que	do.	469	58 lbs.	17 lbs. 12 4-16 ozs.
20	3	Golden Grove P. Fm.	Rondebosch	do.	499	66 lbs.	10 lbs. 9 11-16 ozs.
Totals					6,201	809 lbs.	166 lbs. 15 9-16 ozs.
Grand totals of both sections					8,887	1,164 lbs.	198 lbs. 3 4-16 ozs.

Total number of eggs for 32 weeks, 10,609; total weight, 1,362 lbs. 7 13-16 ozs.

Reviews.

Rhodesia as a White Man's Country.

Dr. W. M. Hewetson, of Sinoia, recently read a paper before the Rhodesia Scientific Association at Salisbury which aroused considerable public interest. He discussed a variety of problems connected with the prospects of a branch of the Caucasian race establishing itself permanently in its purity as a nation within the tropics, "the first blondes in the history of the world to accomplish that feat."

The subject has now been expanded in a monograph published by the author and issued by the Rhodesia Independent Co., Ltd. (2s. 6d.), which well deserves the serious scrutiny of those who have established homes in this country, especially such as are concerned in the vital problem of bringing up a family.

The arguments both ways are many and cogent, and cannot be marshalled or summarised within this brief review. Readers will probably arrive at diverse conclusions according to the pieces of evidence which most impress them, coupled with their own personal experience.

The optimists will, however, be forced to realise that if this is to be a white man's home, certain reasonable precautions are necessary in order that future generations may persist and thrive, whilst pessimists will recognise that by artificially influencing environment in a way quite possible to civilised man, the conditions of nature may be vastly modified.

If man were a beast without ability to meet such influences as the prejudicial rays of the sun, excessive variations of temperature, and exposure to infection by diseases peculiar to the region, then no doubt races originating in the temperate zones might degenerate and disappear in the tropics. Under civilised man's care, however, this does not appear to be true even of domestic animals brought from higher latitudes, where these are reasonably protected by such humanly devised processes as housing, attention and inoculation, whether artificial or controlled by drugs or dips.

Admitting that the blonde races, and more particularly the Teutonic tribes, the English, Dutch, Norse and Germans mentioned by Dr. Hewetson, are out of their natural environment, we have in point of fact so far not only persisted, but thriven, and there seems hope at least that we are as a race likely permanently to continue in this part of the world; always providing we adapt ourselves.

The tile hat and frock coat, the diet and meal hours of the British Isles, the national beverages of cold countries, the hours of business,

the Britisher's cold bath even, the design of houses, protection against fly, precautions as to exposure, dress and exertion, all these must be altered out of respect for tropic climate and elevation above the sea.

Dr. Hewetson, whilst by no means reassuring as to ultimate destiny, yet indicates many helpful ways of fighting adverse conditions. His book should be read, studied and discussed by all Rhodesians, and even if hope, rising eternal, leads us to believe that Rhodesia is now and always will remain a country fit for European settlement, yet after absorbing the views expressed, it may be realised that this desirable consummation is only to be achieved with due regard to the many necessary precautions indicated in these wise words of warning.

E.A.N.

An Indexed System of Veterinary Treatment, by William Scott, F.R.C.V.S., with the collaboration of various writers. Royal 8vo, pp. xx., 636, with 193 illustrations. 1922. London: Bailliere, Tindall & Cox, 8, Henrietta Street, Covent Garden. (Price 31s. 6d. net, plus postage.)

In presenting this treatise to the veterinary profession, the author states that it was written with the object of making treatment of diseases a speciality, and for convenience of reference it is arranged in alphabetical form. Whilst fully alive to its imperfections and incompleteness, he trusts that it may serve the student as a useful chart when he embarks upon the inexact sea of practical therapeutics, and the practitioner as a "refresher" in his routine work. Mr. Scott has been assisted in this work by various distinguished veterinary surgeons, of whom Lieutenant-Colonel Watkins-Pitchford is best known to South Africans.

In dealing with such a work it is only natural that one should turn to the diseases and conditions with which he is most familiar, and it is feared that in this respect those members of the profession who are engaged in the various Dominions and Colonies in combating pests and plagues of stock will be disappointed at the meagre and in some cases out-of-date information and methods described. The section dealing with black-quarter is a typical example of what is referred to. In the case of a severe outbreak, vaccination by the double method is recommended, whilst if the infection is mild, "single vaccination for economic reasons answers one's purposes." There is no reference to the nature of these vaccines or to the more modern and scientific products, such as aggressin, which have to a large extent taken the place of the powders, pellets and strings in the tail.

Further examples could be given where important subjects might have been treated more fully and with greater clarity, but on the whole the work has much to commend it and will undoubtedly be appreciated by the profession as a handy and convenient work of reference.

J.M.S.

Guide to Dairying in South Africa. by R. Brougham Cook. Published by T. Maskew Miller, Capetown (Price 10s. 6d.)

This handbook has been specially written for South African dairy farmers, and although it does not contain much that is new, it deals almost entirely with practical dairying as carried on in South Africa.

The author does not enter into the details of technical subjects such as the manufacture of cheese, butter or condensed milk, but confines himself mainly to such questions as the establishment of a dairy herd, the treatment, feeding and common diseases of dairy stock, the handling and treatment of milk and cream, and the breeding and rearing of pigs for bacon production.

This book fulfils a long-felt want, and should meet with a ready sale. It is well printed and illustrated with photographs of cattle, housed and fed under South African conditions

T.H.

An Elementary Text Book of Physics and Chemistry for use in South African Schools, by W. A. Clegg, B.Sc. (Victoria), Principal, Boys' High School, Wynberg, and L. P. Bosman, B.A., B.Sc., A.I.C., F.C.S. Pp 149, 5 x 7. Capetown T. Maskew Miller, Educational Publisher, 1922 (Price 3s. 6d.)

In the prefatory note to this essentially practical volume the authors mention that it covers the physics and chemistry portions of the new secondary school course of the Union Department of Education, Standards VII. and VIII.

The work seems to have been most carefully and accurately prepared, and the subject-matter is set out clearly and concisely with the aid of numerous diagrams. The book is well printed, and should prove of great use to those for whom it is primarily intended

G.N.B.

Southern Rhodesia Veterinary Report.

August, 1922.

AFRICAN COAST FEVER.

MELSETTER DISTRICT.—At the Randfontein centre of infection there were two deaths.

All restrictions imposed in connection with the Quagga's Hoek area were withdrawn, no case of disease having occurred for fifteen months.

CHARTER DISTRICT.—A fresh outbreak occurred on the Enkeldoorn commonage, which adjoins the infected farm Swartfontein; one animal died.

The following mortality occurred at previously infected areas:—Wiltshire Estate 79, Swartfontein 4, Chipisa 8.

MATOBO DISTRICT.—No case of disease having occurred for fifteen months, all restrictions were withdrawn.

QUARTER-EVIL.

The following mortality in cattle was reported:—Marandellas 2, Macheke 6, Umtali 6, Melsetter 5, Hartley 8, Victoria 25, Nyamandhlovu 4, Inyati 4, Bulawayo 16, Plumtree 15, Umzingwane 18, Matobo 2, Belingwe 2, Gwanda 2, Antelope 4, and one Persian ram in the Insiza district.

CONTAGIOUS ABORTION OF CATTLE.

Centres of infection previously unknown were reported from Lomagundi, Mrewa, Umtali, Gwelo, Bulawayo and Plumtree districts.

TUBERCULOSIS.

A suspicious case occurred in the Salisbury district. The tuberculin test was positive, and the animal was destroyed.

TRYPANOSOMIASIS.

Several cases in cattle reported in the vicinity of Sipolilo, in the Lomagundi district, and on a farm on the Portuguese border, Melsetter district.

IMPORTATIONS.

From the Union of South Africa:—Bulls 59, heifers 21, horses 32, mules 23, donkeys 52, sheep 1,423, goats 595.

EXPORTATIONS.

To Union of South Africa :—Slaughter cattle 2,666, bulls 3, cows 4, horses 2, pigs 97. To Congo :—Sheep 65. To Northern Rhodesia :—Horses 1, mules 2, sheep 71. To Portuguese East Africa :—Bulls 5.

September, 1922.

AFRICAN COAST FEVER.

MELSETTER DISTRICT.—A fresh outbreak occurred on the farm Elandsberg, which adjoins the previously infected farms Merino and Sable Home; nine deaths occurred. At Merino the mortality was fifteen head.

CHARTER DISTRICT.—No fresh outbreaks. The mortality at existing centres of infection was as follows—Wiltshire Estate 22, Swartfontein 6, Chipisa 4, Mooifontein 1.

In the report for the previous month a fresh outbreak in the Sabi Reserve, a few miles east of the Wiltshire Estate, should have been recorded. So far only one animal has been affected.

ANTHRAX.

A recrudescence of infection occurred on the farm Ceres, in the Shamva section of the Mazoe district; 14 head of cattle died. All in-contact animals were vaccinated.

CONTAGIOUS ABORTION OF CATTLE.

Centres of infection previously unknown were reported from the Mazoe, Darwin, Lomagundi, Victoria, Umtali and Makoni districts.

HORSE-SICKNESS.

The following mortality was reported :—Victoria district. Mules 1, horses 1. Salisbury district: Mules 1.

MYIASIS (SCREW WORM) OF CATTLE.

A few cases reported from the Plumtree and Gwanda districts.

STIFF-SICKNESS (STIJFZIEKTE).

The District Veterinary Surgeon, Gwelo (Mr. J. Park Hamilton), submitted the following interesting report :—

"The term 'stijfziekte' is used generally in South Africa to describe certain affections in cattle in which interference with the locomotory apparatus is the primary symptom.

"In Southern Rhodesia the term 'stiff-sickness' is used to describe only one form of 'stijfziekte,' this is what is also known as 'three-day sickness,' and is now almost looked upon as a benign disease, as in most cases the affected animal after three days' illness, characterised by inability to use its limbs, becomes all right again, and as the treatment consists of leaving the animal alone, this particular disease after it is once seen does not cause alarm.

"I have lately observed another form of 'stiff-sickness' which in many respects resembles the genuine South African 'stijfziekte,' and possibly this form has not been recorded before in Southern Rhodesia. The particulars of this outbreak are as follows:—The disease occurred on a farm about twelve miles from Gwelo. In February, 1922, the owner told me that many of his breeding cows were showing a great craving for bones, and were continually coming to the homestead looking for bones. A few weeks later many of these cows began to go very lame and have difficulty in travelling. Altogether about fifty animals were affected. All those affected were breeding cows, and mostly those with calves. Oxen and young stock remained on the same ground and were unaffected.

"*Symptoms.*—The main symptom was difficulty in locomotion: the affected animal moved with a peculiar stilted gait, not unlike laminitis, and had the spine somewhat arched. This symptom pointed to an inflammatory condition of the bones below the knee and the hock; there was, however, no swelling of the joints as is seen in the most severe form of this disease, nor was there evidence of grooving and upturning of the hoofs, which is a symptom of the 'stijfziekte' caused by eating the plant known as *Crotalaria burkeana*.

"All the animals, naturally on account of pain when walking, lay about a great deal, and on account of not grazing sufficiently fell away considerably in condition; so much so that three cows were destroyed simply because of their excessive weakness.

"Curiously enough the milk did not seem to vary much in quantity or quality, as the calves of affected mothers maintained their condition.

"These symptoms, after persisting for about three months, began to gradually subside, and apparently all the remaining affected animals are going to recover.

"*Treatment.*—No treatment was attempted, except giving a little food to some of the animals not able to forage for themselves.

"*Probable Causes.*—It is difficult to point to a direct cause; but the symptoms shown, and only the cows with or carrying calves being affected, seem to suggest that possibly the disease has something to do with an absence of phosphorus in the natural food.

"This theory is further strengthened by the knowledge that these cattle are grazing on new veld which is very rough and coarse, and has not been previously grazed. This fact leads me to hope

that as the veld becomes grazed down the new veld will contain a greater phosphoric content, and in time provide the required amount of phosphorus.

"All the neighbouring farms are well stocked, and I have never recorded the sickness.

"I am indebted for considerable information about this disease to an article on 'Facts and Theories about Stijfziekte and Lamziekte,' by Dr. Arnold Theiler, published in the second report of the Director of Veterinary Research, Pretoria, 1912."

IMPORTATIONS.

From the United States of America:—Bulls 1. From the Union of South Africa:—Bulls 54, heifers 68, horses 4, mules 3, donkeys 18, sheep 1,024, goats 581.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 1,750, bulls 2, cows 429. To Belgian Congo:—Slaughter cattle 216. To Northern Rhodesia:—Horses 4, sheep 130.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

Agricultural Outlook.

The season generally has opened propitiously, rains having fallen during October in practically every district, but the distribution of the rainfall has not been uniformly good, some localities receiving nothing till late in October. Apart from the forecast of meteorological experts, it is interesting to note the weather signs popularly believed by the natives to be indications of a good season. An abundance of certain fruits, particularly the mahobohobo or mjanje, and the mabola, also known as the mahasha or mchakata, is one sign. Both these fruits have been very plentiful this year. Secondly, they believe that a relatively heavy fall in October is a promise of heavy and continuous rain for the season. So far then, popular opinion supports the forecast of the meteorologist, for the latter anticipates a normal season.

As is so often the case, in some districts the losses of cattle after the earliest rains were more severe than before the drought was broken. This is probably due to sudden change of diet, with excess of green food, and also to poisoning by veld plants. There can be no doubt that the early October rains saved the lives of thousands of head of cattle, and the rapidity with which stock as a whole recovered condition was remarkable. It is to be feared that some of the first sowings of maize have been scorched off by excessive heat during the period following the first rains, but it is early yet, and replanting should be possible, especially as the weather during the last half of November was very satisfactory, both storms and steady rains being experienced in most parts. It is probable that ploughing and planting have been in some instances delayed on account of the poor condition of working oxen, but unless a long dry spell should occur during the growing period, there is every reason to anticipate a really good agricultural year.

RHODESIAN MILK RECORDS TO DATE.

Name of cow.	Breed.	Commenced record.	Milk in lbs. Latest return.	Butter fat in lbs. Latest return.	Milk in lbs. to date.	Butter fat in lbs. to date.	Time from commencement of record.	Name and address of owner.
Granny	Friesland	9/10/21	167	7.18	4,549	195.36	Lactation complete	J. S. Struthers, Palm Tree, Sinoia
Cherry Blossom	do	do	76	3.95	5,327	267.56	do	do
Snowflake	do	22/1/22	87	3.85	3,949	146.34	do	do
Lady	do	4/2/22	167	7.51	3,694	158.15	do	do
Corral	do	19/2/22	315	17.33	5,381	273.22	do	do
Maureen	do	10/8/22	479	20.59	1,300	51.37	77 days	do
Rosebud	do	17/9/22	378	15.12	588	23.62	42 do	do
Bell	do	8/10/22	494	19.76	494	19.76	21 do	do
Aggie	do	3/9/22	448	15.68	1,071	38.73	56 do	Knight & Folkes' ad, Lochinvar, Sby.
Peggy	Cape cow	do	525	21.00	1,071	38.47	56 do	do
Daisy	Friesland	do	560	21.84	1,197	42.22	56 do	do
Joan	Shorthorn	do	539	24.26	1,029	44.64	56 do	do
Banjo	do	9/8/22	415.8	13.43	1,448.6	48.59	84 do	C. G. T. Cooper, Essexvale.
Betta	do	do	437.5	18.51	1,449.7	57.09	84 do	do
Four-bab	do	16/8/22	386.4	14.72	1,207.5	48.88	77 do	do
Baby	do	4/10/22	418.6	15.20	418.6	15.20	28 do	do
Sarah	do	do	431.4	14.04	431.4	14.04	28 do	do
Begonia	Friesland	19/9/22	1,810	61.54	3,564	121.19	60 do	J. A. Baxter, Victoria Street, Sby.
Polly	do	1/5/22	506.5	...	2,229.5	...	123 do	G. M. Huggins, Salisbury.
Beauty	do	1/6/22	375.5	...	1,402.5	...	92 do	do
Jean	do	1/5/22	312.5	...	1,437	...	123 do	do
Nancy	do	30/7/22	786.5	...	1,097.5	...	43 do	do
Peggy	do	15/7/22	188	...	518.5	...	40 do	do
Fancy IV.	do	6/5/22	323	...	4,180	...	168 do	C. F. Anthony, Gwelo.
Ringte Emma	do	26/8/22	473	...	1,120	...	56 do	do

N. B.—A gallon of milk weighs approximately 10 lbs.

DEPARTMENT OF AGRICULTURE,
Southern Rhodesia.

Price List of Forest-Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds

OBTAINABLE AT THE GOVERNMENT FOREST NURSERY,
SALISBURY.

*Trees, 25 in tin, at 1d. each, £3 per 1,000. Orders of 5,000 or
over, £2 10s. per 1,000.*

Botanical name.	Common name.	Price of seed.		
		Lb.	Oz.	Pkt.
Callitris calcarata ...	Black pine ...	15/-	1/-	
„ robusta ...	White cypress pine			
„ whytei ...	M'lanje cedar			
Casuarina cunninghamiana	Beefwood ...		2/-	1/-
Cupressus arizonica				
„ lusitanica ...	Portuguese cypress ...	5/-	6d.	
„ sempervirens (var. horizontalis)	Common spreading cypress			
„ sempervirens (var. pyramidalis)	Common upright cypress			
„ torulosa ...	Himalayan cypress ...	10/-	9d.	
Cedrela toona ...	Toon tree ...	15/-	1/-	
Callistemon speciosus ...	Bottle brush ...		2/-	1/-
Eucalyptus botryoides ...	Botryoides gum ...	15/-	1/-	
„ citriodora ...	Lemon-scented gum ...	15/-	1/-	
„ crebra ...	Narrow-leaved ironbark	15/-	1/-	
„ cornuta ...	Yate tree			
„ globulus ...	Blue gum ...	15/-	1/-	
„ hemilampra ...	Red mahogany ...	15/-	1/-	
„ longifolia ...	Woolly butt ...	15/-	1/-	
„ meliodora ...	Yellow box gum ...	15/-	1/-	
„ maidenii ...	Maiden's gum			
„ maculata ...	Spotted gum ...	15/-	1/-	
„ pilularis ...	Black butt ...	15/-	1/-	
„ paniculata ...	Grey ironbark	15/-	1/-	
„ punctata ...	Leather jacket	15/-	1/-	
„ rostrata ...	Red gum ...	15/-	1/-	

Botanical name.	Common name.	Price of seed.		
		Lb.	Oz.	Pkt
Eucalyptus resinifera ...	Red mahogany ...	15/-	1/-	
„ robusta ...	Swamp mahogany ...	15/-	1/-	
„ siderophloia ...	Broad-leaved ironbark ...	15/-	1/-	
„ sideroxylon ...	Red ironbark ...	15/-	1/-	
„ stuartiana ...	Apple-scented gum ...	15/-	1/-	
„ saligna ...	Sydney blue gum ...	15/-	1/-	
„ tereticornis ...	Forest red gum ...	15/-	1/-	
Fraxinus americana ...	American ash ...			
Grevillia robusta ...	Silky oak ...			1/-
Jacaranda mimosaeifolia ...	Jacaranda ...			1/-
Ligustrum lucidum ...	Chinese privet ...			
Pinus halepensis ...	Aleppo pine ...			
„ insignis ...	Remarkable pine ...			
„ pinaster ...	Cluster pine ...			
Phytolaca dioica ...	Belhambra ...			1/-
Rhus lancea ...	Karreeboom ...	10/-	9d.	
Thuya orientalis ...	Thuya ...		1/-	1/-
Tecoma smithii ...	... ..			1/-

Trees and Shrubs, 4 in tin, at 6d. each.

Botanical name.	Common name.	Price of seed, pkt.
Bauhinia spp. ...	White and mauve flowers ...	1/-
„ galpini ...	The pride of De Kaap ...	
Cinnamomum camphora ...	Camphor ...	
Eugenia braziliensis ...	Brazilian cherry ...	
Eugenia sp. ...		
Dalbergia sissoo ...	The sissoo ...	1/-
Freylinia tropica ...		
Pittosporum undulatum ...	Camphor laurel ...	
Pereskia aculeata ...	Barbadoes gooseberry ...	
Populus deltoidea (var. missouriensis) ...	Carolina poplar ...	
Photinia japonica ...	Loquat ...	
Psidium pomiferum ...	Gnava ...	
Spathodea campanulata ...		
„ nilotica ...		
Sterculia platanifolia ...		

24 in tin, at 3d. each.

Aberia caffra ...	Kei apple ...	
Pittosporum undulatum ...	Camphor laurel ...	
Freylinia tropica ...		

4 in tin, at 3d. each.

Botanical name.	Common name.	Price of seed, pkt.
Casuarina cunninghamiana ...	Beefwood ...	1/-
Callitris calcarata ...	Black pine	
„ robusta ...	White cypress pine	
„ whytei ...	M'lanje cedar	
Cupressus arizonica ...	Arizona cypress	
„ lusitanica ...	Portuguese cypress	
„ torulosa ...	Himalayan cypress	
„ sempervirens (var. pyramidalis)	Common upright cypress	
„ sempervirens (var. horizontalis)	Common spreading cypress	
Cedrela toona ...	Toon tree ...	1/-
Callistemon speciosus ...	Bottle brush ...	1/-
Grevillea robusta ...	Silky oak ..	1/-
Jacaranda mimosaeifolia ...	Jacaranda ...	1/-
Pinus insignis ...	Remarkable pine	
„ halepensis ...	Aleppo pine	
Thuya orientalis ...	Thuya	
Populus alba ...	White poplar (suckers, at 3d. each)	
Salix babylonica ...	Weeping willow	

Trees and Shrubs, at 6d. each : extra large, up to 3s. each.

Althaea (Hibiscus syriacus) ...	Christmas rose—white	
Aloysia citriodora ...	Scented verbena—white	
Abutilon sp. ...	Chinese lantern—yellow	
„ variegated ...		
Acacia baileyana ...	Bailey's wattle—yellow	
„ pycnantha ...	Pycnantha wattle—yellow	
Aberia caffra ...	Kei apple	
Allamanda sp. ...	—, pink	
Bauhinia spp. ...	Bauhinia—mauve and white	1/-
„ galpini ...	Pride of De Kaap—red	1/-
Bolusanthus speciosus ...	Rhodesia tree wistaria	
Buddleia sp. ...	—, blue	
„ sp. ...	—, orange	
Brugmansia knightii ...	Moonflower—white	
Cassia capensis ...	Cape laburnum—yellow	
Carica papaya ...	Paw paw	
Callistemon sp. ...	Bottle brush—scarlet	1/-
Ceratonia saligna ...	Locust bean	
Cestrum aurantiacum ...	Ink berry—yellow	
Cytisus scoparius ...	Broom—yellow	
Croton sylvaticus ...	Mount Selinda linden	
Dahlia imperialis ...	Tree dahlia—white	1/-
Dahlia ...	Sunflower dahlia—yellow	1/-
Duranta plumieri ...	Tree forget-me-not—blue	
Deutzia crenata ...	Bridal wreath—white	
Euphorbia fulgens ...	—, scarlet	
„ splendens ...	Christ's thorn—red	
Gardenia florida ...	Katjepeering—white	
Holmskioldia sanguinea ...	—, red	
„ ...	—, yellow	

Botanical name.	Common name.	Price of seed, pkt.
<i>Hypericum quartianum</i> ...	—, yellow	
„ <i>laueolatum</i> ...	—, yellow	
<i>Hibiscus</i> sp. ...	—, double and single—red	
<i>Heliotropium peruvianum</i> ...	Heliotrope	
<i>Hydrangea hortensis</i> ...	Hydrangea—pink, blue	
<i>Iochroma</i> sp. ...	Iochroma—red	
„ sp. ...	„ —blue	
<i>Moschosma</i> ...	Rhodesian spirea—blue	
<i>Lupinus arborea</i> ...	Tree lupin—yellow	
<i>Lagerstroemia indica</i> ...	Pride of India—mauve and pink	
<i>Lasiandra</i> ...	—, purple	
<i>Michelia champaca</i> ...		
<i>Melia azadarach</i> ..	Syringa—blue	
<i>Punica granatum</i> ...	Pomegranate—red	
<i>Photinia japonica</i> ...	Loquat	
<i>Psidium guayava</i> ...	Guava	
<i>Persea gratissima</i> ...	Avocado pear (at 3/- each)	
<i>Plumieri rubra</i> ...	Frangipani	
<i>Platanus orientalis</i> ...	Plane tree	
<i>Plectranthus</i> sp. ...	Rhodesian tree lobelia	
<i>Poinsettia</i> ...	—, double and single—red, yellow and blue	
<i>Streptosolon jamesonii</i> ...	—, orange	
<i>Sterculia acerifolia</i> ...	—, red	
<i>Sapindus muskurossi</i> ...	Soap nut tree	
Sensitive plant ...		
<i>Salvia</i> sp. ...	—, scarlet, blue and yellow	
<i>Tecoma smithii</i> ...		
<i>Thevetia neriifolia</i> ...	Thevetia	
<i>Wistaria sinensis</i> ...	Wistaria	
<i>Weigelia rosea</i> (Diervilla) ...		

Climbers and Creepers.

Botanical name.	Common name.	Plants, each.	Seed, pkt.
<i>Aristolochia sypho</i> ...	Dutchman's pipe ...	6d.	
<i>Bougainvillea</i> ...	—, magenta and brick red ...	1/-	
<i>Beaumontia grandiflora</i> ...	—, white ...	1/-	
<i>Bignonia venusta</i> ...	Golden shower ...	1/-	
„ sp. ...	—, mauve ...	6d.	
Jasmine ...	—, yellow and white ...	6d.	
„ <i>sambac</i> ...	—, white ...	1/-	
<i>Hedera helix</i> ...	Ivy ...	6d.	
<i>Lonicera periclymenum</i> ...	Honeysuckle—yellow ...	6d.	
„ <i>sempervirens</i> ...	„ red ...	6d.	
<i>Mandevilla suaveolens</i> ...	Mandevilla—white ...	6d.	1/-
<i>Passiflora edulis</i> ...	Granadilla ...	6d.	
„ sp. ...	Fiji granadilla ...	6d.	
<i>Podranea brycei</i> ...	Zimbabwe creeper—pink ...	6d.	1/-
<i>Rosa bracteata</i> ...	MacCartney rose—white ...	9d.	
<i>Solanum wendlandii</i> ...	Potato creeper—blue ...	6d.	

Hedge Plants.

The following species may be used as hedge plants : —

Botanical name.	Common name.
Aberia caffra ...	Kei apple
Callistemon ...	Bottle brush
Cupressus arizonica ...	Arizona cypress
„ lusitanica ...	Portuguese cypress
„ torulosa ...	Himalayan cypress
Duranta plumieri ...	Tree forget-me-not
Eugenia braziliensis ...	Brazilian cherry
Freylinia tropica ...	
Holmskioldia ...	Holmskioldia
Pittosporum undulatum ...	Camphor laurel
Ligustrum lucidum ...	Chinese privet
Rhus lancea ...	Karreeboom
Thuya orientalis ...	Thuya
Rosa bracteata ...	MacCartney rose
Punica granatum ...	Pomegranate

Farming Calendar.

December.

BEE-KEEPING.

Honey in good quantities will still be coming in, as the welcome rains will be beneficial to veld blooms. Continue to give room by extracting honey from shallow frames, then return these to be refilled. Extracted honey should be drawn from the machine into the honey ripener, into which it should be strained through several thicknesses of butter muslin, remaining there, to allow surplus water to evaporate, for five days, then draw off from the tap into clear white glass bottles. All bottles must be cleansed thoroughly. See that ventilation is ample on hot days.

CITRUS FRUITS.

Citrus trees can be planted out at any time between October and the end of January. The best time is the end of October or early November, when the ground is warm and trees have hardened up their first growth of season, i.e., spring growth, and are in fit condition to commence second growth, which they will do if transplanted properly at that time—end of October. Citrus trees should not be planted later than the end of January, as the growth they put on after planting later than this is very liable to be still sappy at the approach of winter, and consequently more sensible to the effect of cold. The young trees require to be well watered after planting. The soil around them should never be allowed to be really dry, but, on the other hand, it must not be kept in a state of sogginess. Immediately after planting protect the stems of the young trees from the sun by whitewashing or covering up with grass. Cut the tree down so as to leave a stem of about 2 ft. 6 ins. or 3 ft. long, and form the head of the future tree in the top 8 ins. or 1 ft., according to the best position of the shoots, not more than three or four in number. All other growths to be suppressed whenever they appear. Keep the soil nice and loose by digging, forking or hoeing round the young trees. It will then not be necessary to water them so frequently. The orchard should by this time have been thoroughly ploughed, and any cover crop sown already be up and growing. Don't forget, before the wet season, the first ploughing should be up and down the steepest gradient of the orchard, and be followed immediately after harrowing by cross-ploughing across the hill. This is to obviate as much as possible erosion of the soil during the coming heavy rains. Remember that, if a long spell of dry weather occurs during the so-called wet season, your bearing orange trees will probably require an application of water, otherwise the crop of fruit may receive a check from which it will never properly recover.

CROPS.

This is the busiest planting month of the farm year, during which most crops should be sown. Main crop maize planting is usually commenced in November and continued through December, but should be finished if possible at latest by Christmas. Light harrowing with the Hallick weeder or light tooth harrow soon after germination of the maize and until the plants are 6 to 10 inches high is beneficial, most in keeping down weeds and maintaining a soil mulch. This harrowing is better done during the heat of the day, when plants are less liable to break off. Other crops which will be

sown during the month are ground nuts, velvet beans, sunflower, cowpeas, pumpkins, mangold, majorda melons, linseed, hibiscus and Sunn hemp for fibre or seed.

DAIRYING.

The summer now being far advanced, attention should be given to the percentage of fat in cream, as the cream should contain a higher percentage in the summer than in the winter. Adjust the cream screw of your separator so that you obtain cream testing from 40 to 50 per cent. butter fat. The reason for this is that a heavy bodied cream carries better than one testing only 30 per cent., and will remain sweeter during a long journey. Most separators are adjusted to skim cream testing about 45 per cent. butter fat, and if an excessively high testing cream is produced the efficiency of the separator will be impaired and a loss will be sustained in the separated milk. So do not attempt to separate cream of a higher test than 50 per cent. Cheese making is now in full swing, and it should be remembered that good cheese cannot be made from tainted or acid milk. Clean milk is essential for cheese making, and it can only be obtained by the provision of a milking shed with an impervious floor. Milking in a muddy kraal will result in a gassy bitter cheese being produced. During the wet months the provision of a dry, warm shelter for calves is essential. Exposure to inclement conditions of weather and retention of the calves in a filthy, muddy kraal will result most probably in an epidemic of white scour and ophthalmia. Commonsense treatment and commonsense housing are necessary if dairy calves are to be successfully reared.

During this month provision for winter feed should be made by sowing maize for silage, pumpkins, sweet potatoes, cattle radish, mangels, sunflowers both for seed and silage, ground nuts, teff grass, Boer manna, Sudan grass, beans and cowpeas.

ENTOMOLOGICAL.

Maize.—Plant during first half of this month to avoid stalk borers. See "Maize Stalk Borer," *Agricultural Journal*, December, 1917. Distribute poisoned bait shortly before or immediately after planting on red soils to destroy various pests, including surface beetles, snout beetles, etc., which may affect the stand. See "Maize on Red Soils," *Agricultural Journal*, April, 1919. Cutworms and Maize Beetle (*Heteronychus*) may be in evidence. See "Cutworms," *Agricultural Journal*, August, 1918, and the "Maize Beetle," *Agricultural Journal*, February, 1918.

Tobacco.—The newly planted crop is subject to the attack of cutworms, surface beetles, stem borers, leaf miners, "wireworms," grasshoppers, large crickets, etc. A good deal of protection may be obtained by dipping the tops of the transplants as far as the roots in arsenate of lead 1 lb. to 15 gallons of water. See *Agricultural Journal*, December, 1919, and February, 1920.

Potato.—Ladybirds may be injurious to the foliage. See "Two Ladybirds injurious to Potato Plants," *Agricultural Journal*, October, 1913. On sandy soils blue blister beetles may be troublesome. An immediate spraying with arsenate of lead 1 lb. to 12 gallons water should give relief.

Cabbage, Turnip, etc.—Webworm and diamond back moths are still the main pests. See "Cabbage Webworm," *Agricultural Journal*, February, 1914. Dusting with Paris green and lime should give protection against both pests.

Bean.—Stem maggot may be serious in December, especially if previous crops have been grown for French beans in gardens. See "Bean Stem Maggot," *Agricultural Journal*, April, 1913.

Melon, Marrow, etc.—Leaf-eating beetles frequently destroy the very small plants entirely. Spray with an arsenical and sugar wash or dust with Paris green 1 lb., lime 20 lbs.

Deciduous Trees.—Chafer beetles, fruit beetles are commonly very troublesome. See "Chafer Beetles," *Agricultural Journal*, December, 1914.

Fig.—Collect and destroy all fruit infested with fig weevil, and any wild figs near to the orchard.

Mosquitoes, House Flies, Stable Flies.—Destroy all breeding places round homestead. Poison or trap adults. See *Agricultural Journal*, June, 1915, and December, 1916.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

FORESTRY.

Give the ground the final harrowing, and if the season is a normal one, planting out should commence. This is the ideal month for planting out in a normal season, as the young trees have the benefit of all the summer rains, and become well established before the dry winter months arrive. Plant on dull, rainy days, or failing such days, late in the afternoons.

POULTRY.

Some of the birds will now be moulting. As they commence to do so, it is advisable to put them into a separate pen and treat them in such a manner as to get them through their moult as quickly as possible and on the lay again. They should be given additional food of the nature of linseed, monkey nuts, sunflower seed and leaves, green food of the Brassica tribe, i.e., cabbage, kale, cauliflower leaves, etc., and a little flowers of sulphur (one teaspoonful to 1 lb. of dry mash) daily. The above assists the growth of the feathers. The birds that moult late are usually the best layers, and these should be marked.

During the wet season the birds must be kept dry, as also the houses, otherwise the egg yield will drop and the birds themselves fall off in health.

No young cockerels or cocks should be running with any of the birds now. The hatching season does not begin again till April, and all eggs should be unfertile now.

Turkey hatching should have concluded six weeks to two months ago, as young turkeys less than this age will, if they become wet, either die or become stunted. Hatching of turkeys can commence again when the wet season is finished.

Ducklings can be hatched all the year round, but there are two important points to be noted, viz., they must sleep on absolutely dry bedding and must be kept out of the hot sun. Those destined for killing should be kept in a small run, allowed very little exercise, fed all they will eat, in order to be ready for the table in from eight to ten weeks. Ducks are profitable only when treated in this manner, and their owner can get contracts for so many per week.

STOCK.

Cattle.—The veld in most districts is now good, and little trouble in respect of grazing is likely to be experienced. Ranching cattle should not require any attention beyond dipping, but any stock that are in weak condition will be the better for a little hay or a pound or two of maize at night until they have regained strength. The bulls should be returned to the herd either at the end of the month or in January, and it should be remembered that the better they are conditioned and fitted for their work the more hope there is of a good crop of calves. For this reason also every effort should be made to have all the female stock in strong condition. Dairymen will find that as the grass becomes lush and rank a supply of sweet veld hay, taff hay or, say, three pounds of crushed maize given in the sheds at night will enhance both the quality and quantity of the milk. This will be found

to be the case more particularly in districts of heavy rainfall. Milch cows should be protected as much as possible from cold rains and hot sun. Yarding all night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather. Dipping should be regularly attended to.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on freshly prepared soil. Transplanting should be pushed as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertilisers to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

VETERINARY.

Occasional cases of horsesickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gallsickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland usually six inches of rain fall this month, and in Matabeleland five inches, but considerable variations occur. Less rain usually falls at this time in extreme southern parts of the country. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight or may extend to six weeks; in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe, to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

January.

BEE-KEEPING.

Where it is desirable, artificial swarms can now be made, so also can nuclei be formed from proved best working strains. All the above must be stimulated with food. In the cooler districts it will be necessary to contract the entrances and close down for winter.

CITRUS FRUITS.

(See under December notes.)

CROPS.

Sowing of maize and beans for ensilage and Sunn hemp or beans for green manuring may be continued up to the middle of the month. Hay crops such as teff grass, manna, Sudan grass and summer oats should go in during the first week of this month. Napier fodder, Kikuyu and other grasses may be planted out, and catch crops of teff and buckwheat can be put in up to the end of the month.

DAIRYING.

(See December.)

ENTOMOLOGICAL.

Maize.—This crop is subject to the attack of stalk borer, maize beetle (*Heteronychnus*), snout beetles, grasshoppers, crickets, etc. See *Agricultural Journal*, April, 1919. Maize planted after the first of the year is extremely liable to almost complete failure as a crop from the second brood of the stalk borer. See *Agricultural Journal*, December, 1917. This is of less importance in regard to ensilage.

Tobacco.—Most of the pests of this crop are active during January. e.g., stem borer, leaf miner, "wireworms," surface beetles, large crickets, grasshoppers, etc. See *Agricultural Journal*, December, 1919, February, 1920.

Potato.—Certain ladybirds are apt to defoliate the young potato plants of the main crop, especially on farms where early potatoes are also grown. See *Agricultural Journal*, October, 1913. Blue blister beetles are apt to be injurious on sandy soils, and may be checked by spraying with arsenate of lead 1 lb. to 12 gallons of water. Spraying should be commenced for early blight. See *Agricultural Journal*, August, 1913.

Cabbage Family.—Plants of this family are subject to the attacks of webworm and sawfly in January. See *Agricultural Journal*, February, 1914, April, 1910, April, 1917, June, 1918.

Beans and Cowpeas.—These suffer chiefly from stem maggot. See *Agricultural Journal*, April, 1913. On small plots aphids may be checked by spraying with tobacco wash or paraffin emulsion.

Melon Family.—The chief pests in January are leaf-eating beetles. Spray with an arsenical wash or cover young plants.

Citrus Trees.—The fruit is subject to the attack of citrus codling. Collect and destroy the infested fruits. For this and other citrus pests see *Agricultural Journal*, February, 1916.

Deciduous Fruits.—These are all subject to the attack of fruit-eating beetles. See "Chafer Beetles," *Agricultural Journal*, December, 1914. Fruit moths are injurious during this month, the only preventive measure being to net the trees. For fruit fly remedies, see *Agricultural Journal*, August, 1911.

Fig.—The adult beetles of the fig borer are to be found on the young shoots. They should be destroyed. The grubs in the stems may be killed with a little carbon di-sulphide.

Mosquitoes, House Flies, Stable Flies.—See under previous month.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with

attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon as they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or failing that, on a dull day, or late in the afternoons.

POULTRY.

Grading and selection of the breeding birds should now commence. Only the very best layers and strongest and most vigorous birds should be chosen. When selected, it is advisable to let them run on free range before confining them to the breeding pens next month.

This is the month, for those intending to start poultry keeping, to commence getting the houses, runs, etc., in order, and everything should be ready for the breeding stock by the middle of February. Leave nothing undone, and never have recourse to make-shifts, which are fatal to success. Commence to keep the eggs for hatching at the end of the third week in February, and keep no eggs longer than ten days. They must be kept in a cool, even temperature, and out of draughts. Place them on their small ends and turn every alternate day. A bad hatch is often the result of keeping the eggs under wrong conditions. There are also many other causes, e.g., weak stock, stock that are too fat, lack of green food, lack of scratching exercise, uneven temperature in the incubator room, lack of fresh air, vibration, lack of sufficient moisture, etc.

All last season's pullets, if hatched at the right time and reared well, should now be laying well. Don't make any sudden change in the quarters, in the arrangements of the interior fittings of the houses, in the food, etc., otherwise the birds will stop laying and go into a partial moult. Kill any weak chicks at once: they will never make good, profitable birds, and are not worth the time and trouble of rearing. Never help a chick out of the shell; if it is not strong enough to get out of itself, it is no good. Give the chicks no food for the first thirty-six hours after hatching. Keep them absolutely quiet, and let them sleep. Take time by the forelock and have the incubators working and in good order several days before the eggs are ready to put in.

If broody hens are to be used for hatching, commence to lay in a stock at once. The Mashona fowl is excellent for this purpose, but as soon as they are purchased, dip them, isolate them for a fortnight, and dip them again. There will then be no likelihood of them bringing in disease or insects. As soon as each bird becomes broody put her on two or three china eggs, when they will be ready to take the settings of eggs as they are produced by the breeding birds.

If birds in the breeding pens show signs of broodiness, stop them at once. You want eggs from them for hatching; they must not waste time in sitting.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Bulls should be returned to the herd during the month if a September or October calving season is desired.

Sheep.—Continue as recommended for December. If heavy rains are experienced a daily ration of half a pound of maize per ewe will keep them in condition and will often prevent much trouble arising from poverty and anæmia. Those who favour autumn lambs must put the ram again with the flock in February, and should therefore now take steps (if necessary) by supplying a little extra feed as above recommended to fit the ewes for mating.

A little forethought of this kind will tend to increase the stamina of the lambs and to bring the ewes in season more or less together, so that a protracted lambing season is avoided.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform plants for producing seed for next season's crop.

VEGETABLE GARDEN.

Turnips, carrots, cabbage, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

VETERINARY.

Horsesickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, seven-and-a-half in the north, and less as one travels westwards or southwards. At this time of year the rainfall tends to be heavier in the eastern than in the western portions of the Territory, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.

Southern Rhodesia Weather Bureau.

SEPTEMBER AND OCTOBER, 1922.

Pressure.—During the month of September the mean barometric pressure was normal over the whole country.

The fluctuations in the barometric pressure during the month were large, the maximum range amounting to 0.22 in. at Bulawayo and 0.16 in. at Salisbury.

High pressure areas were present from the 1st, 3rd, 8th, 12th and 17th to 22nd, the maximum high on the 2nd being 0.14 in. above normal at Bulawayo and 0.10 in. above normal at Salisbury.

The maximum low on the 29th was 0.08 in. below normal at Bulawayo and 0.06 in. below normal at Salisbury.

During the month of October the mean barometric pressure was slightly below normal (0.02 in.) in the southern portion of the country, and normal elsewhere.

The fluctuations in the barometric pressure during the month were very large, the maximum range amounting to 0.34 in. at Bulawayo and 0.22 in. at Salisbury.

High pressure areas were present from the 9th to 13th and from the 23rd to 29th, the maximum high on the 26th being 0.16 in. above normal at Bulawayo and 0.11 in. above normal at Salisbury.

The maximum low occurred on the 7th, and was 0.18 in. below normal at Bulawayo and 0.11 in. below normal at Salisbury.

Temperature.—During September the mean temperature was above normal over the bulk of the country, but was below normal in the south, and varied from 2.6° above normal at Salisbury to 0.8° below normal at Bulawayo. The mean daily temperatures varied from 1.4° below normal at Bulawayo to 3.9° above normal at Salisbury, whilst the mean night temperatures varied from 1.6° above normal at Umtali to 0.3° below normal at Bulawayo.

During October the mean temperature was below normal over the whole country, and varied from 1.8° below normal at Bulawayo to normal at Umtali.

The mean daily temperatures varied from 2.5° below normal at Bulawayo to 1.0° below normal at Salisbury, whilst the mean night temperatures varied from 2.7° above normal at Umtali to 1.1° below normal at Bulawayo.

Rainfall.—Scattered light showers were recorded throughout the country on the 29th and 30th September, and the early rains set in generally at the beginning of October.

The early arrival of the general rains was very welcome, as the veld was in very poor condition owing to the serious drought last season.

The first rain period lasted from the 1st to 18th, and good showers were recorded generally throughout this period.

During 19th to 22nd only light showers were recorded at a very few stations in the Territory.

During the 23rd to 25th good showers were recorded in Matabeleland and south-eastern Mashonaland, but the showers were localised, and more akin to the usual October conditions.

During the 26th to 30th only light showers were recorded at a few stations, and on the 31st good showers were reported fairly general.

During November to date (17th) there has been a marked slackening off in the rains, particularly in Mashonaland, the fall during November to date being generally below normal.

This, however, is not serious, and cannot be regarded as altogether disadvantageous.

The following is the mean rainfall recorded in the various zones to the end of October:—

	Inches.	Normal. Inches.
Zone A (Western Matabeleland)	2.27	1.16
Zone B (South-Eastern Matabeleland) ...	2.63	1.54
Zone C (Western Mashonaland)	2.58	1.41
Zone D (North-Eastern Mashonaland) ...	3.24	1.69
Zone E (South-Eastern Mashonaland) ...	3.89	1.84
Zone F (Eastern Border)	3.66	3.70

RAINFALL.

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Sept.	Oct.		
ZONE A. :				
Bubi—				
Imbesu Kraal ... ..	...	1·58	1·58	1·13
Inyati ... ..	...	1·89	1·89	1·12
Maria Farm	·05	2·09	2·14	...
Shangani Estate ... ..	...	1·71	1·71	1·07
Bulalima—				
Kalaka	—	1·17	1·17	1·22
Riverbank	·08	3·25	3·33	1·09
Bulawayo—				
Fairview Farm	·14	3·16	3·30	1·10
Keendale ... ..	...	1·39	1·39	0·98
Lower Rangemore ... ..	...	3·27	3·27	1·11
Observatory	·01	2·25	2·26	1·13
Paddy's Valley	·10	1·85	1·95	1·10
Gwelo—				
Dawn	·07	2·13	2·20	1·24
Somerset Estate ... ..	...	—	—	...
Insiza—				
Thornville ... ..	...	3·72	3·72	1·23
Nyamandhlovu—				
Impondeni ... ..	...	2·02	2·02	—
Naseby ... ..	...	1·47	1·47	1·12
Gwaai Reserve	·07	1·92	1·99	1·12
Wankie—				
Lynwood ... ..	...	·98	·98	1·33
Waterford ... ..	...	1·42	1·42	·90
Sebungwe—				
Gokwe ... ..	...	2·74	2·74	·97
ZONE B. :				
Belingwe—				
Bickwell ... ..	...	2·36	2·36	1·00
Bubje Ranch ... ..	...	2·35	2·78	·94
Bulalima—				
Edwinton ... ..	...	2·14	2·14	1·45
Garth ... ..	...	3·00	3·09	1·20
Maholi ... ..	...	4·24	4·24	1·78
Retreat ... ..	...	1·54	1·54	·98
Sandown ... ..	...	4·23	4·23	1·63
Tjomanpie ... ..	...	—	—	—
Gwanda—				
Gwanda Gaol ... ..	...	2·89	3·04	·96
Mtshabezi Mission ... ..	...	1·93	1·95	1·06
Insindini ... ..	...	2·31	2·31	n.s.
Limpopo	·11	3·11	3·69	n.s.
Tuli ... ..	...	—	—	—
Insiza—				
Albany ... ..	...	2·44	2·44	·98
Filabusi ... ..	...	2·16	2·16	1·00
Fort Rixon	·15	2·74	2·95	1·02
Infiningwe	·01	3·52	3·54	1·16

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Sept.	Oct.		
ZONE B.—(Continued)				
Insiza (Continued)—				
Lancaster	2·34	2·34	n.s.
Matobo—				
Holly's Hope	1·71	1·71	1·05
Matopo Mission	3·27	3·27	1·00
Rhodes Matopo Park	·06	—	—	1·09
Umfula	2·10	2·10	n.s.
Umzingwane—				
Essexvale	2·43	2·43	1·13
Koihwayo	2·30	2·30	n.s.
ZONE C. :				
Charter—				
Bushy Park	2·75	2·75	1·35
Enkeldoorn	2·63	2·63	1·49
Marshbrook	3·71	3·71	1·50
Range	3·15	3·15	1·59
Umnati	·85	·85	1·19
Vrede	2·01	2·01	1·47
Chilimanzi—				
Allanberry	1·32	1·38	1·23
Central Estates	2·11	2·11	1·37
Gwelo—				
Cross Roads	2·89	2·89	0·94
East Clare Ranch	·30	·30	n.s.
Globe and Phoenix Mine	—	—	—	—
Gwelo Gaol	·02	3·45	—	·97
Indiva	1·15	1·15	n.s.
Lyndene	2·06	2·06	n.s.
Rhodesdale Ranch	2·00	2·00	·97
Hartley—				
Ardgowan	—	3·67	3·67	1·48
Balwearie	1·67	1·67	n.s.
Beatrice...	2·64	2·64	1·50
Carnock	2·86	2·86	1·60
Philippaugh	3·85	3·85	1·70
Cromdale	5·23	5·23	1·50
Elvington	3·97	3·97	1·60
Gatooma	3·08	3·08	1·60
Gowerlands	2·95	2·95	1·54
Hallingbury	2·10	2·10	1·44
Hartley Gaol	2·26	2·26	1·65
Hopewell	5·51	5·51	1·31
Jenkinstown	4·72	4·72	1·52
Ranwick	2·84	2·84	1·44
Spitzkop	1·54	1·54	1·47
Lomagundi—				
Argyle	1·56	1·56	1·69
Baguta	3·27	3·27	1·51
Citrus Estate	·04	3·16	3·20	1·56
Darwendale	4·36	4·44	1·59

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Sept.	Oct.		
ZONE C.—(Continued)				
Lomagundi (Continued)—				
Dingley Dell ... ..	...	1.50	1.50	n.s.
Freda ... ..	...	2.13	2.13	1.92
Gambuli ... ..	.05	2.43	2.48	1.93
Gungurubee ... ..	...	4.56	4.56	...
Impingi... ..	...	2.95	2.95	...
Lone Cow Estate ... ..	...	—	—	1.73
Mafoota... ..	.02	1.33	1.35	n.s.
Maningwa ... ..	...	2.89	2.89	1.81
Mapandagutu ... ..	.07	3.15	3.22	n.s.
Mukwe River Ranch ... ..	...	2.69	2.69	1.60
Nyapi ... ..	...	2.76	2.76	n.s.
Nyaroro... ..	.02	2.03	2.05	n.s.
Nyati ... ..	.05	3.55	3.60	n.s.
Palm Tree Farm ... ..	...	1.81	1.81	1.66
Richmond ... ..	...	2.33	2.33	...
Sangwe ... ..	.09	2.27	2.36	n.s.
Silate Estate ... ..	...	5.76	5.76	n.s.
Sinoia ... ..	.14	3.01	3.15	1.60
Sipolilo ... ..	...	1.33	1.33	1.61
Talfourd ... ..	...	3.66	3.66	1.76
Umboe ... ..	...	3.20	3.20	n.s.
Umvukwe Ranch ... ..	...	6.03	6.03	1.61
Salisbury—				
Avondale ... ..	...	2.10	2.10	1.64
Botanical Experiment Station...	.07	1.23	1.36	1.70
Bromley ... ..	.43	2.20	2.65	1.75
Cleveland Dam ... ..	.01	2.20	2.29	1.57
Gwebi	—	—	—	1.65
Hillside ... ..	.04	2.49	2.53	1.61
Lilfordia ... ..	.05	...	...	1.54
Lochinvar ... ..	...	1.98	1.98	n.s.
Manor Farm ... ..	.33	3.30	3.63	n.s.
Salisbury Gaol ... ..	.03	1.85	1.91	1.63
Sebastopol ... ..	...	2.42	2.48	1.66
Selby	—	3.27	3.41	1.44
Stapleford ... ..	...	7.32	7.43	1.73
Tisbury ... ..	.06	2.48	2.59	1.60
Vainona ... ..	.03	2.13	2.38	1.74
Sebungwe—				
Sikombela ... ..	...	3.10	3.10	1.40
ZONE D. :				
Darwin—				
La Belle Esperance...	...	1.25	1.25	n.s.
Mount Darwin ... ..	...	1.15	1.17	1.60
Inyanga—				
Inyanga ... ..	.11	2.07	2.33	1.90
Juliasdale ... ..	.11	3.99	4.51	n.s.
Rhodes Estate	—	—	—	1.86
York ... ..	.07	4.03	4.75	...

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.	
	Sept.	Oct.			
ZONE D (Continued)					
Makoni—					
Eagle's Nest	...	05	2·85	2·95	1·69
Forest Hill	3·10	3·10	1·81
Riversdale...	4·54	4·54	n.s.
Wensleydale	...	18	3·88	4·06	1·70
Marandellas—					
Rastunburg	3·12	3·12	n.s.
Mazoe—					
Atherstone	2·74	2·74	n.s.
Avonduur	4·89	4·89	...
Benridge	1·49	1·49	1·86
Bindura	2·58	2·58	1·81
Ceres	3·53	3·53	1·98
Chipoli	1·87	1·87	1·67
Citrus Estate	3·62	3·71	1·66
Craigengower	5·38	5·48	1·83
Glen Divis	2·01	2·01	n.s.
Great B...	1·56	1·56	n.s.
Kilmer	...	09	5·02	5·19	1·84
Kingston	4·10	4·20	1·92
Mazoe	4·18	4·18	1·68
Marienzi	...	03	—	—	—
Marston...	1·78	1·78	n.s.
Mgutu	3·31	3·31	1·42
Omeath	...	02	4·10	4·12	1·65
Pearson Settlement	...	—	—	—	—
Ruia	3·94	4·94	1·89
Ruoko Ranch	...	02	3·38	3·54	1·72
Shamva	2·09	2·09	1·78
Stanley Kop	...	01	85	1·96	1·59
Sunnyside	3·52	3·59	1·73
Teign	...	14	...	...	n.s.
Usk	2·64	2·80	n.s.
Virginia	...	02	5·22	5·33	1·61
Visa
Woodlands	1·74	1·74	n.s.
Zombi	4·35	4·54	1·70
Mrewa—					
Glen Somerset	5·55	5·55	1·83
Mrewa	6·59	6·59	1·80
Selous Nek	2·41	2·49	1·78
Mtoko—					
Makaha	2·77	2·98	1·93
Mtoko	2·54	2·54	1·48
Salisbury—					
Arcturus	5·46	5·76	...
Chindamora Reserve	1·53	1·53	n.s.
Glenara	3·42	3·42	1·61
Goromonzi	2·93	2·93	1·98
Hatcliffe (Borrowdale)	4·48	4·69	2·70
Hillside (Bromley)	1·24	1·24	...

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Sept.	Oct.		
ZONE D.—(Continued)				
Salisbury (Continued)—				
Kilnuir	4·10	4·10	n.s.
Meadows	4·27	4·34	2·04
Springs	4·91	4·91	n.s.
ZONE E. :				
Belingwe—				
Belingwe	1·79	1·79	n.s.
Inferno Ranch	4·00	4·00	n.s.
Shabani	3·44	3·44	n.s.
Bikita—				
Angus Ranch	2·09	2·26	n.s.
Bikita	4·16	4·16	3·44
Devuli Ranch	n.s.
Charter—				
Buhera	3·40	3·40	1·53
Riversdale	1·70	1·70	1·60
Chibi—				
Chibi	1·15	3·16	3·31
Chilimanzi—				
Chilimanzi	—	2·92	2·92
Driefontein	·03	...	1·39
Felixburg	2·26	2·26
Grootfontein	2·22	2·22
Induna Farm	2·25	2·42	2·72
Requeza Estate	1·32	1·32
Gutu—				
Gutu	·05	2·41	2·46
Glenary	·06	2·43	2·55
M'vimvi Ranch	2·79	2·79
Tel-el-Kebir	3·02	3·12
Gwelo—				
Lover's Walk	3·19	3·19
Oaklands	1·15	3·25	3·40
Partridge Farm	2·56	2·56
Sheep Run Farm	1·39	1·41
Belingwe—				
Belingwe	—	2·53	—
Insiza—				
Rooddeheuvel	2·61	2·61
Inyanga—				
St. Trias' Hill	7·22	7·76
Makoni—				
Chitora...	4·08	4·22
Craigendoran	3·73	3·77
Gorubi Springs	2·12	2·34
Mona	2·73	2·73
Monte Cassino	5·48	5·73
Rusape	5·88	5·88
Springs	1·92	1·92

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Sept.	Oct.		
Zone E.—(Continued)				
Marandellas—				
Bonongwe
Delta	1 94	1 94	1 86
Igudu	3 02	3 06	n.s.
Land Settlement	2 72	2 79	1 68
Lendy Estates	3 83	3 83	1 85
Marandellas	7 52	7 52	1 88
Nelson	1 42	1 42	1 56
Tweedjan	1 49	1 49	2 05
White Gambolo Ranch	1 68	1 68	n.s.
Melsetter—				
Brackenbury	4 68	4 68	2 66
Tom's Hope	4 71	5 75	2 40
Ndanga—				
Doornfontein	3 02	3 12	1 45
Ndanga	4 66	4 97	2 21
Triangle Ranch	1 30
Selukwe—				
Aberfoyle Ranch	2 23	2 26	1 78
Hillingdon	3 31	3 36	1 61
Impali Source	2 37	2 52	n.s.
Makatsi	n.s.
Rio	2 93	3 01	1 49
Tewkesbury	5 23	5 23	n.s.
Umtali—				
Argyll	2 09	2 31	1 86
Gilmerton	1 72	1 83	1 60
Jeraïn	1 10	1 18	1 66
Mutambara Mission	1 76	1 76	1 50
Odzani Power Station	2 23	2 66	1 84
Park Farm	1 90	2 80	n.s.
Premier Estate	2 24	2 81	1 52
Sarum	1 94	2 33	1 86
Stapleford	1 73	1 73	3 26
St. Augustine's Mission	1 57	2 70	2 30
Umtali (Gaol)	1 03	1 43	1 63
Victoria—				
Brucehame	3 44	3 58	1 49
Cambria	n.s.
Chevenden	5 42	5 42	n.s.
Clipsam	2 75	2 88	1 49
Glenlivet	6 58	6 89	n.s.
Gokomere	4 88	4 98	1 34
Histonhurst	5 73	5 73	1 40
Makahori Farm	—	—	1 35
Makorai River Ranch	3 04	3 28	1 72
Mashaba	5 37	5 37	n.s.
Morgenster Mission	6 68	6 85	2 09
M'Sali
Riverdene North	3 97	4 06	1 35
Salemore	2 90	2 90	n.s.

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Sept.	Oct.		
ZONE E.—(Continued)				
Victoria (Continued)—				
Silver Oaks	...	08	—	1.47
Stanmore	2.29	1.45
Summerton	3.58	1.30
Tichidza	...	11	6.69	1.81
Victoria	..	04	2.69	1.35
Zimbabwe	4.17	n.s.
ZONE F.:				
Molsetter—				
Chikore	...	09	2.24	2.43
Chipinga	3.08	2.47
Molsetter	...	46	3.01	2.90
Mount Selinda	...	07	2.47	3.51
Vermont	...	62	4.07	3.38
Untali—				
Hoboken	—	3.02

— means nil.

... means no return.

Dates of Meetings of Farmers' Associations, Southern Rhodesia

(SUBJECT TO ALTERATION)

Name of Association	Place of Meeting	Secretary	1922-3		
			December	January	February
Banket Junction ..	Banket Hotel	C. S. Larter	2	..	3
Beatrice District ..	Farmers' Hall, Beatrice	W. Krienke	28	25	22
Bindura ..	Bindura	G. Aakwe	9	13	10
Donkey ..	Donkey	C. J. Shirley	7	4	1
Eastern Border (South Melsetter)	Arndell's Farm & Mt. Darwin Store alternately	J. W. Goucher	3	fixed	11
Eastern Districts ..	Farm Ravenswood	..	..	..	..
Enkeldoorn ..	Good Hope School	J. Badeneyer	..	..	..
Enkeldoorn ..	Enkeldoorn	Geo. Tully	..	..	..
Enterprise ..	Arturus Hotel	G. G. Pickering	6	3	7
Feilburg—Gutu ..	Willard Farm	F. W. Bradshaw	..	13	10
Greyfriars Branch, R. L. and F. A.	Hytrec Hotel	A. S. Will	27	24	25
Gakoma ..	Hytrec Hotel	E. Sealey-Harvey	..	20	18
Gazaland ..	Speck's Hotel	E. Sealey	10	20	17
Greystone ..	Chipunga Court House	James Ward	..	25	..
Gwanda ..	Various farm houses, Shangani	M. Kerr	9	13	10
Hardley ..	Royal Hotel, Gwanda	A. C. Edmonstone	..	..	..
Headlands ..	Hartley Hotel	J. de L. Nimmo	..	27	24
Hendrina ..	Hendrina Station	J. Grewar	16	..	..
Hunziker Road Siding ..	Hunziker Road Siding	M. E. Welle	..	20	17
Inanga ..	Shangani	E. J. Hackling	..	13	10
Inyanga ..	Rhodes Inyanga Estate	G. H. Everett	9	16	20
Lalapansai ..	Lalapansai	R. E. Courthope Giles	18	15	19
Lalapansai ..	Lalapansai	..	..	5	9
Lomagundi ..	Sinola	W. L. McLean	15	fixed	..
Makwate ..	Makwate	F. W. Robertson	27	31	28
Makwate ..	Makwate	J. G. Monckton	9	13	10
Makoni North ..	Makoni South Farm	Leonel Dobell	2	6	3
Makoni ..	Rusape	H. Jackson	9	3	1
Marandellas, Northern ..	Marandellas Farmers' Hall	W. E. J. Henson	6	..	..
Marandellas, Southern ..	Various farms	R. S. Arnott	7	..	..
Mashonaland ..	Commercial Hotel, Salisbury	M. D. W. Smith	13	fixed	..
Mazoe Branch, R. L. and F. A.	Various farm houses	A. P. B. Smith	..	15	14
Mazoe Central ..	Glendale	J. Harvie	2	..	3
Melsetter ..	Melsetter	R. Wodehouse	..	..	..
Melsetter (North) ..	Cronley	M. Danziger	16	fixed	..
Midlands Farmers and Stockowners ..	Royal Hotel, Gwelo	W. W. Wilcock	16	fixed	20
Northern District ..	Royal Hotel, Norton	W. W. Wilcock	..	..	..
Nyanandlovu ..	Norton Street	G. Graham	..	..	..
Que Que ..	Nyanandlovu	E. J. Ross	16	fixed	17
Rhodesian Landowners and Farmers ..	Que Que	H. S. Hopkins	..	25	..
Selous ..	Library Buildings, Bulawayo	C. C. Douglas	16	fixed	17
Selukwe ..	Various farms	W. J. Simpson	..	..	..
Shamva ..	Selukwe	W. J. Simpson	..	..	..
Umtali ..	Shamva	M. J. Bracewell	21	fixed	15
Umtali ..	Various ranches	J. S. Holland	16	13	11
Umtali ..	Royal Hotel, Umtali	M. W. Graham	7	4	..
Umtali ..	Umtali	W. F. N. Thornton	29	26	23
Victoria ..	Victoria	W. B. Cumming	1	5	2
Wankie District ..	Wankie	W. R. Goucher	9	13	10
Western ..	Plumtree Hotel	..	..	..	..

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

BOTANICAL SPECIMENS FOR IDENTIFICATION.

In all cases where a botanical identification is required it is of the utmost importance that the specimens reach the Department of Agriculture in a thoroughly dry condition, free from mildew, and intact, that is not broken in pieces. Whenever possible specimens should comprise main stem or small branch, leaves, flowers, seed vessels and roots or bulbs, though these need not necessarily be on the same plant.

The colour of the flowers and the general form of the plant should be preserved by pressing and drying between two sheets of blotting paper or newspaper. Ordinary plants not excessively succulent can be dried sufficiently in three days, provided the drying papers are changed every day. A heavy weight should be placed on the specimens in order to press them flat.

Correspondents are asked to supply the following particulars as far as possible:—

- (a) height and general appearance of plant or tree;
- (b) class of soil on which found;
- (c) locality and altitude;
- (d) supposed use or properties.

It is advised that specimens be packed between two sheets of cardboard or thin wood, since in this way they will travel long distances without fear of injury.

FARM SEEDS FOR SALE.

The undermentioned seeds grown on the Government experiment farms are offered for sale at the prices quoted. The quantities available are limited. Prices are f.o.r., Salisbury, or f.o.r., the Gwebi experiment farm. Owing to limited supply, the full delivery of any order cannot be guaranteed. Farmers are therefore requested not to enclose cheques until they are advised as to the amount of seed allotted to them. The seed is consigned carriage forward in the case of stations. In the case of sidings, the cost of railage will be notified after despatch. All applications for seed should be addressed to the Chief Agriculturist and Botanist, Department of Agriculture.

Black-eyed Susan pea	25/- per 100 lbs.
Sunflower, black (not guaranteed pure), from selected heads	15/- per 100 lbs.
Kherson oats	30/- per 100 lbs.
Teff grass	9d. per lb.
Manna	4d. per lb.
Red manna	4d. per lb.
Linseed, white flowering	6d. per lb.
Majorda melon seed from selected melons . . .	1/- per lb.
Pumpkin seed from selected pumpkins	2/6 per lb.
Sweet potato slips	10/- per bag

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 218. Useful Measurements for Maize, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 396. Export of Maize.
- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.

- No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 400. Soil Washing, by A. C. Jennings, Assoc.Mem.Inst.C.E.
- No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
- No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia.
- No. 408. The Velvet Bean, by J. A. T. Walters, B.A.
- No. 416. Grasses of Agricultural Importance in Southern Rhodesia, by H. G. Mundy, F.L.S., G. N. Blackshaw, O.B.E., B.Sc., F.I.C., and E. V. Flack.
- No. 417. The Ground Nut or Monkey Nut, by C. Mainwaring.
- No. 422. Improvement of Rhodesian White Maize by Selection, by C. Mainwaring
- No. 423. The Common Sunflower, by C. Mainwaring
- No. 428. The Sweet Potato, by J. A. T. Walters, B.A.
- No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
- No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
- No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs Ph.D., B.Sc.
- No. 221. Results of Experiments, Longila, 1914 15, by J. Muirhead
- No. 239. Reports on Crop Experiments, Gwebi. 1915-16, by E. A. Nobbs Ph.D., B.Sc.
- No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
- No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
- No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
- No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
- No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm
- No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
- No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 382. Annual Report of Experiments. Experiment Station. Salisbury, 1919-1920.
- No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
- No. 411. Annual Report of Experiments. 1920-21, Experiment Station. Salisbury, by H. G. Mundy, F.L.S.
- No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.
- No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.
- No. 433. Winter Cereal Experiments, 1921. by D. E. McLoughlin.

TOBACCO.

- No. 168. Report on the Methods of Growing, Curing and Selling Bright Tobaccos in Virginia, U.S.A. by H. Kay Scorrer

- No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
 No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
 No. 398. Wildfire and Angular Spot.
 No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision),
 by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.
 No. 410. Common Mistakes in Growing and Handling Virginia Tobacco,
 by H. W. Taylor, B.Agr.
 . Handbook of Tobacco Culture for Planters in Southern Rhodesia,
 price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by
 Eric A. Nobbs, Ph.D., B.Sc.
 No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
 No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season
 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.
 No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D.,
 B.Sc., and B. Haslewood, F.S.S.
 No. 231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs,
 Ph.D., B.Sc., and B. Haslewood, F.S.S.
 No. 247. Statistical Returns of Crops grown by Europeans in Southern
 Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D.,
 B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S.,
 Statistician.
 No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A.
 Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
 No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
 No. 286. Statistics of Live Stock and Animal Produce for the Year 1917,
 by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
 No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and
 F. Eyles, F.L.S.
 No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles,
 F.L.S.
 No. 361. Statistics of Live Stock and Animal Produce for the Year 1919,
 by F. Eyles, F.L.S.
 No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia,
 1919-1920, by H. C. K. Fynn.
 No. 393. Statistics of Live Stock and Animal Produce for 1920, by
 H. C. K. Fynn.
 No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia
 for the season 1920-21, by H. C. K. Fynn.
 No. 426. Statistics of Live Stock and Animal Products for the year 1921,
 by H. C. K. Fynn.

LIVE STOCK.

- No. 123. Feeding and Care of Imported Bulls, by R. C. Simmons.
 No. 145. Prospects of Importation of Cattle from Australia, by E. A.
 Nobbs, Ph.D., B.Sc.
 No. 208. Water in the Diet of Live Stock, by Ll. E. W. Bevan, M.R.C.V.S.
 No. 211. Fattening of Pigs on Granite Farms in Mashonaland, by
 R. C. Simmons.
 No. 227. An Experiment in Beef Production, by R. C. Simmons.
 No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
 No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by
 A. G. Holborow, F.I.C., Assistant Government Agricultural
 Chemist.
 No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.

- No. 255. Pound Fees.
- No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed Farms, by R. C. Simmons.
- No. 292. Branding and Drafting Pens, by R. C. Simmons.
- No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
- No. 336. Butchering and Flaying.
- No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
- No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
- No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
- No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.
- No. 421. From Breeder to Butcher: Cattle Feeding Experiment No. 9, Government experiment farm, Gwebi, by E. A. Nobbs, Ph.D., B.Sc., F.H.A.S.
- Arsenite Cattle Dip—How to Mix.

DAIRYING.

- No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.
- No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
- No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
- No. 356. Cream and its Production, by T. Hamilton.
- No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 395. Farm Butter Making, by T. Hamilton, M.A., N.D.D., N.D.A.
- No. 401. Milk Records and Milk Testing, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 418. Manufacture of Cheddar Cheese, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 427. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
- No. 121. Rabies, by Ll. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
- No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
- No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.
- No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by Ll. E. W. Bevan, M.R.C.V.S.
- No. 324. Infectious Abortion of Cattle, by Ll. E. W. Bevan, M.R.C.V.S. Services of Government Veterinary Surgeons.
- No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.
- No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.
- No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.
- No. 431. History, Control and Treatment of Infectious Abortion in Cattle in Southern Rhodesia, by Ll. E. W. Bevan, M.R.C.V.S.
- Redwater Treatment and Gall Sickness.

IRRIGATION.

- No. 186. Concrete and Reinforced Concrete, by E. Hardcastle, M.I.E.E
- No. 206. Hints on Irrigation: Small Earthen Storage Reservoirs, by W. M. Watt.
- No. 270. Odzani River Irrigation Scheme, by W. M. Watt.
- No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.
- No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
- No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.
- No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.
- No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
- No. 419. Irrigation Canals, by A. C. Jennings. A.M.I.C.E., A.M.I.E.E. Engineering Advice.

FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.
- No. 366. The Management of Woods, by J. S. Henkel.
- No. 379. Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds.
- No. 386. Forestry in Rhodesia: Improvement Fellings on the Farm, by J. S. Henkel.

HORTICULTURE.

- No. 75. Fumigation of Fruit Trees with Hydrocyanic Acid Gas, by R. W. Jack, F.E.S.
- No. 354. The Home Orchard, by A. G. Turner.
- No. 424. Citrus Fruit Growing in Rhodesia, by A. G. Turner.

ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
- No. 147. Root Gallworm, by R. W. Jack, F.E.S.
- No. 158. Two Ladybirds Injurious to Potato Plants, by R. W. Jack, F.E.S.
- No. 171. The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants, by R. W. Jack, F.E.S.
- No. 172. Diseases of the Potato Tuber and the Selection of Sound Seed, by R. W. Jack, F.E.S.
- No. 178. Illustrations of Natural Forest in relation to Tsetse Fly, by R. W. Jack, F.E.S.
- No. 187. The Dusty Surface Beetle, by Rupert W. Jack, F.E.S.
- No. 197. Chafer Beetles, by R. W. Jack, F.E.S.
- No. 204. Some Injurious Caterpillars, by R. W. Jack, F.E.S.
- No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
- No. 219. More Household Insects, by R. Lowe Thompson, B.A.
- No. 228. Rhodesian Citrus Pests, by R. W. Jack, F.E.S.
- No. 233. Does it Pay to Spray Potatoes in Southern Rhodesia? by Rupert W. Jack, F.E.S.
- No. 249. Home-made Fly Papers, by Rupert W. Jack, F.E.S., Government Entomologist.
- No. 261. Turnip Sawfly, by R. W. Jack, F.E.S.
- No. 276. The Maize Stalk Borer, by Rupert W. Jack, F.E.S.
- No. 280. The Maize Beetle, by R. W. Jack, F.E.S.

- No. 290. Notes on Remedies for Turnip Sawfly, by Rupert W. Jack, F.E.S.
- No. 291. Cutworms, by Rupert W. Jack, F.E.S.
- No. 302. A Note on the Maize Stalk Borer, by Rupert W. Jack, F.E.S.
- No. 317. Maize Culture on Red Soil; Value of Poisoned Bait as an Aid to Good Stands, by Rupert W. Jack, F.E.S.
- No. 353. Further Experiments with Poisoned Bait on Maize Lands, by R. W. Jack, F.E.S.
- No. 369. The Bean Stem Weevil, by R. W. Jack, F.E.S.
- No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.
- No. 402. Ticks Infesting Domestic Animals in Southern Rhodesia, by R. W. Jack, F.E.S.
- No. 425. A Newly Recorded Pest of Maize: "Rootworm," by R. W. Jack, F.E.S.

POULTRY

- No. 377. The Fowl Tick, by A. Little.
- No. 406. The Turkey, by A. Little.
- No. 415. Mating for Improvement and Increased Egg Production, by A. Little.
- No. 420. Poultry Husbandry: Housing and Feeding of Adult Fowls, by A. Little.
- No. 434. Some Common Diseases of Poultry, by A. Little

MISCELLANEOUS.

- No. 93. Formation of Agricultural Credit Associations in Rhodesia, by Loudon M. Douglas, F.R.S.E.
- No. 226. Classification of Clouds, by R. H. Scott, F.R.S.
- No. 254. Hints on Explosives, by W. M. Watt.
- No. 264. Nature Notes—Adaptation, by C. F. M. Swynnerton, F.L.S.
- No. 273. Enkeldoorn Produce Express Syndicate Rules.
- No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.
- No. 283. Maize Foods for the Home.
- No. 294. Directions for taking Samples for Analysis, by E. V. Flack, Acting Agricultural Chemist.
- No. 318. Notes on Mining Law for Farmers, by Advocate D. E. McCausland, M.A., LL.B.
- No. 358. Notes on the Regulations governing the Sale of Fertilisers and Farm Foods, by E. V. Flack.
- No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
- No. 391. Hints on Brickmaking, by G. T. Dyke.
- No. 414. Limestones in Southern Rhodesia, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- Malarial Fever: How it is caused and how it may be prevented, by Sir Ronald Ross, F.R.C.S., D.Sc., LL.D., F.R.S., K.C.B., etc.
- The Analyses of Agricultural Products, Soils, Water, etc.
- Lectures for Farmers.
- Farming Returns for Income Tax Purposes.

Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 438.]

[22nd September, 1922.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to declare that, notwithstanding the provisions of section 17 of Government Notices No. 17 of 1917 and No. 331 of 1922, the use of oxen for draught purposes may be permitted within the area described hereunder, under such conditions as the Controller of Stock shall prescribe.

Description of Area.

That portion of the new Sabi road lying between the Tanganda River and the township of Chipinga, in the native district of Melssetter.

No. 458.]

[6th October, 1922.

IT is hereby notified that His Honour the Administrator has been pleased, under section 5 of "The Pounds and Trespasses Ordinance, 1903," at the request of the Civil Commissioner, Bulawayo, to establish a pound on Thornville farm, Insiza native district, and that the said pound is now available for the public.

No. 442.]

[29th September, 1922

CATTLE INDUSTRY.

IT is hereby notified that Eric Arthur Nobbs, Esquire, Ph.D., B.Sc., F.H.A.S., Director of Agriculture (Chairman), Milton Evan Cleveland, Esquire, Charles Spearman Jobling, Esquire, Howard Unwin Moffat, Esquire, M.L.C., and Otto Christian Rawson, Esquire, have been appointed a Committee of Enquiry in respect of the cattle industry of Southern Rhodesia.

The terms of reference to the Committee of Enquiry are published in the annexure hereto.

Mr. Alfred Bertram Woods has been appointed Secretary to the Committee.

COMMITTEE OF ENQUIRY

In respect of the Cattle Industry of Southern Rhodesia.

To Eric Arthur Nobbs, Esquire, Ph.D., B.Sc., F.H.A.S., Director of Agriculture, Milton Evan Cleveland, Esquire, Charles Spearman Jobling, Esquire, Howard Unwin Moffat, Esquire, M.L.C., and Otto Christian Rawson, Esquire.

Whereas it appears to me desirable that an enquiry should be held with the object of ascertaining the facts and making recommendations regarding the following matters:—

- (1) the quantity and quality of cattle available for export now and in the near future;

- (2) the markets to which the industry may look for the disposal of such surplus;
- (3) the best means of encouraging and developing export to such markets; and
- (4) generally as to the prospects of the industry and the possibilities of improving the position in regard thereto.

Now, therefore, I do nominate you, the said Eric Arthur Nobbs (Chairman), Milton Evan Cleveland, Charles Spearman Jobling, Howard Unwin Moffat and Otto Christian Rawson, to be members of a Committee for the purpose of enquiring into and reporting upon the matters aforementioned.

And I do hereby desire and request that you, or any two or more of you, do, as soon as the same can conveniently be done, using all diligence, report to me from time to time your proceedings in writing.

And I do hereby desire and request that all officials of the Public Service, all land owners, cattle owners and those interested in the cattle industry, be assistant to you in the execution of these presents, by giving all such information as may be in their power to impart.

And I do further desire and direct that you shall have access to and examine all such official books, documents, papers and records as may afford the fullest information on the subjects of your enquiry, and that you shall have power to enquire of and concerning the premises by all other lawful ways and means whatsoever.

DRUMMOND CHAPLIN.
Administrator.

No. 523.]

[10th November, 1922.

AFRICAN COAST FEVER.

IT is hereby notified that Arthur Edwin Speight, Esquire, B.A., LL.B., Legal Adviser (Chairman), John Arnold Edmonds, Esquire, and James Struthers, Esquire, have been appointed a Committee of Enquiry in respect of cattle diseases.

The terms of reference to the Committee of Enquiry are published in the annexure hereto.

COMMITTEE OF ENQUIRY.

To Arthur Edwin Speight, Esquire, B.A., LL.B., Legal Adviser, John Arnold Edmonds, Esquire, and James Struthers, Esquire.

Whereas it appears to me desirable that a committee should be appointed to—

- (1) enquire into and report on the origin and circumstances attending the recent outbreak of African Coast Fever at the Wiltshire Estate and certain other farms in the Charter and Chulmanzi districts;
- (2) enquire into and report on the adequacy or otherwise of the measures taken to prevent the spread of the disease;
- (3) enquire into and report on the manner in which the "Cattle Cleansing Ordinance, 1918," was carried out in the aforesaid districts.

Now, therefore, I do nominate and appoint you, Arthur Edwin Speight, John Arnold Edmonds and James Struthers, to be members of a Committee of Enquiry for the purposes of enquiring into and reporting upon the matters aforementioned.

And I do hereby desire and request that you, or any two or more of you, do, as soon as the same can conveniently be done, using all diligence, report to me your proceedings in writing.

And I do hereby desire and request that all cattle owners, officials of the Public Service and those interested in the eradication of diseases of cattle be assistant to you in the execution of these presents by giving all

such information as it may be in their power to impart; and I do further desire and direct that you shall have access to and examine all such official books, documents, papers and records as may afford the fullest information on the subjects of enquiry, and that you shall have power to enquire of and concerning the premises by all other lawful ways and means whatsoever.

DRUMMOND CHAPLIN,
Administrator.



**AMERICA'S
PIONEER
DOG
REMEDIES.**

**BOOK ON
DOG DISEASES
AND HOW TO FEED**

Mailed Free to any Address
by the Author

H. CLAY GLOVER CO., Inc.,
129, West 24th Street, New York, U.S.A.
Postage to the United States of America 18 3d

WINDMILLS



ALSTON'S NEW PATENT

ENCLOSED DOUBLE GEARED WINDMILLS are PERFECTION

Their Reliability is Proverbial.
Fitted with Machine-Cut Gears, Ball Bearings, Auto Lubrication, and Storm-Proof Regulators. All Working Parts Enclosed in a Dust-Proof Case and run in oil.
Over 80,000 Alston Mills now in use.
If unable to procure locally write us direct.
Expert advice and catalogues free.
JAMES ALSTON & SONS Pty. Ltd.
Queen's Bridge, Melbourne, Australia

Rhodesia Agricultural Journal.

INDEX, VOLUME XIX., 1922.

	PAGE
Abortion in Cattle ..	277
" " Vaccine ..	470
" of Cattle: History, Control and Treatment of in Southern Rhodesia, by L. E. W. Bevan, M.R.C.V.S.	554
Advice upon Irrigation and Engineering Matters ..	332
African Coast Fever ..	10
" (Editorial) ..	261
" Enquiry ..	642
Agricultural Experiments (Editorial) ..	127
" Outlook .. 92, 222, 346, 468, 621,	738
An Additional Poultry Expert (Editorial) ..	642
Angular Spot and Wildfire, by D. D. Brown ..	205
Annual Report of Crop Experiments, Gwebi Experiment Farm, 1921-22, by H. G. Mundy, F.L.S.	656
Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.	45
Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S. .. 536 and	694
Anthrax ..	171
Appointment of Botanist (Editorial) ..	645
Arlington Sand Veld Experiment Station, 1st Report, Winter Crops, 1921, by H. G. Mundy, F.L.S., and E. E. Wright ..	68
Baboon Trap (Editorial) ..	385
" by H. C. K. Fynn ..	210
Barley, Malting ..	83
" Rates for ..	9
Beatrice District Farmers' Association ..	149
Beggar Weed and Kudzu Vine ..	288
Biology, Elementary: Review ..	612
Botanic Gardens, Salisbury (Editorial) ..	647
Botanist, Appointment of (Editorial) ..	645
Breeder to Butcher: Cattle Feeding Experiment No. 9, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S. ..	267
Breeder to Butcher: Cattle Feeding Experiment No. 10, by H. G. Mundy, F.L.S. ..	588
Budget (Editorial) ..	262
Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S. ..	583
Bulawayo Show ..	444
Bulletins, Departmental .. 113, 245, 374, 491, 632,	764
Butter Making, Common Defects in, by T. Hamilton, M.A., N.D.A., N.D.D.	402

iv.

	PAGE
Calendar, Farming	98, 238, 348, 473, 623, 745
Canals, Irrigation, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E. . .	187
Canning Factory, Odzi	679
Cattle Cakes and Meals (Editorial)	643
„ Children's Judging Competition (Editorial)	509
„ Dip, St. O'Gorman	79
„ Dual Purpose, in Southern Rhodesia	209
„ Feeding Experiment No. 9, Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.	267
„ Feeding Experiment No. 10, by H. G. Mundy, F.L.S.	588
„ History, Control and Treatment of Infectious Abortion, by L. E. W. Bevan, M.R.C.V.S.	554
„ Industry, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.	53, 453, 551, 711
„ „ Committee of Enquiry (Editorial)	641
„ Returns, Rhodes Inyanga Estate, 1917-1921, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.	419
„ Squeezer	212
„ Transport Areas	363, 487
<i>Cedrela toona</i>	458
Cereal Experiments, Winter, 1921, by D. E. McLoughlin	593
Cheese, Cheddar, by T. Hamilton, M.A., N.D.A., N.D.D.	177
„ Making, Farm, by T. Hamilton, M.A., N.D.A., N.D.D.	675
Chief Veterinary Surgeon, Southern Rhodesia, Report for 1921	429
Children's Cattle Judging Competition (Editorial)	509
Chillies in Rhodesia, by G. H. Gordon	533
Citrus Fruit Growing in Rhodesia, by A. G. Turner	159 and 301
„ Industry (Editorial)	384
„ Trees, Importation of (Editorial)	133
Climatic Areas in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.	459
Common Defects in Butter Making, by T. Hamilton, M.A., N.D.A., N.D.D.	402
Common Mistakes in Growing and Handling Virginia Tobacco, by H. W. Taylor, B.Agr.	37
Common Sunflower, by C. Mainwaring	295
Composition of Grasses, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C. . .	134
Congo Market	705
Contagious Abortion in Cattle	276
„ Vaccine	470
Correspondence—Sword Bean (<i>Canavalia gladiata</i>)	344
Costs of Maize Production (Editorial)	506
Cotton (Editorial)	511
Crop Experiments (Editorial)	4
„ Arlington, 1921, 1st Report, by H. G. Mundy, F.L.S., and E. E. Wright	68
„ Gwebi Experiment Farm, 1921-22, by H. G. Mundy, F.L.S.	656
„ Salisbury, 1920-21, by H. G. Mundy, F.L.S.	45
„ Salisbury and Gwebi, 1921-22	64
„ 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.	536 and 694

	PAGE
Crop Statistics (Editorial)	4
Crops, Statistics for the Season 1920-21, by H. C. K. Fynn .	29
Customs Returns (Editorial)	261
Dairy Herds, Use of Pure Bred Sires, by T. Hamilton, M.A., N.D.A., N.D.D.	282
„ Industry (Editorial)	3
Dairying Industry (Editorial)	132
„ in South Africa, Guide to (Review)	733
Departmental Bulletins. See "Bulletins"	
„ Notices	112, 244, 363, 487, 630, 762
Dipping Tanks (Editorial)	646
Director of Agriculture, Annual Report for 1921	313
Diseases amongst the Domestic Animals of Southern Rhodesia since the Occupation, by J. M. Sinclair, M.R.C.V.S.	10, 169, 276, 720
Diseases of Animals in South Africa (Review)	228
„ of Poultry, by A. Lattle	601, 702
Drought (Editorial)	258
Dual Purpose Animal in Southern Rhodesia	209
East Coast Fever (Editorial)	384
Egg Laying Test, Southern Rhodesia	93, 215, 218, 463, 727
Elementary Biology for South African Schools .	612
Elephant Grass	198
Engineering Matters, Advice upon	332
Entomological Branch, Notes from, by R. W. Jack, F.E.S.	333
Ephemeral Fever of Cattle	279
Epizootic Lymphangitis	724
Experiments, Agricultural (Editorial)	127
„ Crop (Editorial)	4
„ „ Arlington Sand Veld, 1st Report, by H. G. Mundy, F.L.S., and E. E. Wright	68
Experiment Station, Salisbury, Annual Report, 1920-21, by H. G. Mundy, F.L.S.	45
Experiments, Crop, 1921-22, Salisbury and Gwebi	64
„ „ „ by H. G. Mundy, F.L.S.	536, 694
„ „ Gwebi Experiment Farm, 1921-22, by H. G. Mundy, F.L.S.	656
Experiments, Crop, Co-operative	112, 241
Experiment Station, Bulawayo, 1st Report, by H. G. Mundy, F.L.S.	583
Experiments, Winter Cereal, 1921, by D. E. McLoughlin	593
Exportation of Plants, Seeds, etc (Editorial)	9
Exports (Editorial)	386
Export Trade in Ground Nuts (Editorial)	387
Farm Cheese Making, by T. Hamilton, M.A., N.D.A., N.D.D.	675
Farmers' Associations' Meetings	111, 237, 362, 486, 629, 761
„ Income Tax Returns	478
Farm Food Prosecution (Editorial)	643
Farming Calendar. See "Calendar."	
„ Profits (Editorial)	646
„ Returns for Income Tax Purposes	515

VI.

	PAGE
Fertilisers and Farm Foods Registered in Year ended March, 1923	772
First Rhodesian Tobacco (Editorial)	644
Flaying, Curing and Drying Hides, by R. R. Needham	342
Foot and Mouth Disease	170
Forest Reserve, Mtao (Editorial)	642
Forest-Tree Transplants, Shrubs, etc., Price List	740
Forestry in Southern Rhodesia: Planting and Care of Forest Trees, by J. S. Henkel	687
Fruit Farm, New Zealand, by Miss E. C. Steedman	85
Fruit Growers' Exchange of South Africa, Ltd. (Editorial)	5
Fruit Growing Industry (Editorial)	128
Fruits, Insect Pests of, in Southern Rhodesia, by R. W. Jack, F.E.S.	569, 664
Geological Formations in Southern Rhodesia, by H. B. Maufe	280
Glanders	720
Government Notices 119, 251, 380, 497, 638,	770
Grass, Molasses	89
Grasses of Agricultural Importance in Southern Rhodesia, by H. G. Mundy, F.L.S., and G. N. Blackshaw, O.B.E., B.Sc., F.I.C.	134
Grasses of Agricultural Importance in Southern Rhodesia (Editorial)	124
Grasses in Rhodesia	439
Ground Nuts (Editorial) 8 and	130
„ by C. Mainwaring	150
„ Export Trade in (Editorial)	387
Gwebi Farm, Crop Experiments, 1921-22, by H. G. Mundy, F.L.S.	656
„ Experiment Farm, Harvesting Operations, by R. H. Cardwell	718
„ „ Particulars of Experiments in Progress, 1921-22	66
„ „ Visit to (Editorial)	256
„ „ „	461
Gwelo Show	447
Harvesting Operations at Gwebi Experiment Farm, by R. H. Cardwell	718
Hides, Flaying, Curing and Drying of, by R. R. Needham	342
High and Low Veld Maize (Editorial)	506
History, Control and Treatment of Infectious Abortion of Cattle in Southern Rhodesia, by L. E. W. Bevan, M.R.C.V.S.	554
History of Stock Diseases in Southern Rhodesia (Editorial)	7
„ the Infective Diseases amongst the Domestic Animals of Southern Rhodesia, by J. M. Sinclair, M.R.C.V.S.	10, 169, 276, 720
Importation of Citrus Trees (Editorial)	133
Improvement of Rhodesian White Maize by Selection, by C. Mainwaring	291
Income Tax Returns	478
„	515
Infectious Abortion of Cattle in Southern Rhodesia, by L. E. W. Bevan, M.R.C.V.S.	554

	PAGE
Insect Pests of Fruit other than Citrus in Southern Rhodesia, by R. W. Jack, F.E.S.	569 and 664
Inyanga Estate, Cattle Returns, 1917-1921, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.	419
Irrigation and Engineering Matters, Advice	332
„ Canals, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.	187
„ in Rhodesia, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.	683
„ Loans (Editorial)	390
„ Notes	214 and 462
Kudzu Vine and Beggar Weed	288
„ Propagation of, by H. C. Arnold	435
Lemon Yeast	312
Limestones in Southern Rhodesia, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.	73
Loans, Irrigation (Editorial)	390
Locusts in Rhodesia (Editorial)	259
Locust Pest (Editorial)	132
Lomagundi Show	451
Lymphangitis, Epizootic	724
„ Ulcerous	722
Maize and Maize Meal Rates	275
„ Growers (Editorial)	265
„ High and Low Veld (Editorial)	506
„ Matters (Editorial)	504
„ Pink Grub	336
„ Production and Costs (Editorial)	506
„ Rhodesian White. Improvement of by Selection, by C. Mainwaring	291
„ Rootworm	333
„ Seed (Editorial)	504
„ Stalk Borer, by R. W. Jack, F.E.S.	87
„ Store	469
„ Successes at Johannesburg (Editorial)	514
„ Trade (Editorial)	125
„ White v. Yellow	339
„ Yellow v. White (Editorial)	505
„ Yields (Editorial)	7
Malaria and Blackwater Fever (Editorial)	384
Malting Barley	83
Manufacture of Cheddar Cheese, by T. Hamilton, M.A., N.D.A., N.D.D.	177
Milking Competition, Salisbury Show	616
Milk Records (Editorial)	5, 128, 263, 388, 512, 647
„ Southern Rhodesia	90, 224, 471, 618, 739
Molasses Grass	89
Monkey Nut, by C. Mainwaring	150
Mtato Forest Reserve (Editorial)	642

VIII.

	PAGE
Napier Fodder	194
New Year (Editorial)	1
New Zealand Fruit Farm, by Miss E. C. Steedman	85
Northern Rhodesia Importation Regulations (Editorial)	133
Notes from the Entomological Branch, by R. W. Jack, F.E.S.	333
„ on the Maize Stalk Borer or "Top Worm," by R. W. Jack, F.E.S.	87
Notices, Departmental. See "Departmental Notices."	
„ Government. See "Government Notices."	
 Odzi Canning Factory	679
Our Exports (Editorial)	386
 Pasture Plants and Grasses in Rhodesia	439
Pig Breeding in Rhodesia (Editorial)	392
„ Industry (Editorial)	510
Pigs Consigned to the Union, Rates for	614
Pink Grub of Maize	336
<i>Pisé de Terre</i> House	343
„ „ (Editorial)	123, 503
Planting and Care of Forest Trees in Southern Rhodesia, by J. S. Henkel	687
Plants and Grasses in Rhodesia	439
Pleuro-pneumonia	16
Poplar, White (Editorial)	265
Possibility of Seasonal Forecasting and Prospects of Rainfall Season 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.	648
Potato, Sweet, by J. A. T. Walters, B.A.	411
Poultry, Common Diseases of, by A. Little	601, 702
„ Expert, Additional (Editorial)	642
„ Husbandry —	
Rhodesia Egg Circle (Editorial)	126, 257, 512
Housing and Feeding of Adult Birds, by A. Little	200
Mating for Improvement and Increased Egg Production, by A. Little	80
Southern Rhodesia Egg Laying Test, 93, 215, 218, 463, 727	
Industry (Editorial)	2, 126
Price List of Forest-Tree Transplants, etc.	740
Propagation of Kudzu Vine, by H. C. Arnold	435
 Quarter Evil	173
 Rabies	725
Rainfall Returns	106, 232, 356, 481, 754
„ Season : Possibility of Forecasting, and Prospects for 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.	648
Rates for Barley	9
„ Maize and Maize Meal	275
„ Pigs Consigned to the Union	614
Redwater and Gall sickness Vaccine	20

IX.

	PAGE
Relative Areas of Geological Formations in Southern Rhodesia, by H. B. Maupe	280
Report of Crop Experiments, Gwebi Experiment Farm, 1921-22, by H. G. Mundy, F.L.S.	656
„ Crop Experiments, Salisbury, 1920-21, by H. G. Mundy, F.L.S.	45
„ Crop Experiments, Salisbury, 1921-22, by H. G. Mundy, F.L.S.	536, 694
„ the Chief Veterinary Surgeon for 1921	429
„ the Director of Agriculture for 1921	313
„ the Veterinary Bacteriologist, 1921	605
Reports, Veterinary. See "Veterinary Reports"	
Reviews	
An Elementary Biology for South African Schools	612
An Elementary Text Book of Physics and Chemistry for use in South African Schools	733
An Indexed System of Veterinary Treatment	732
Diseases of Animals in South Africa	228
Guide to Dairying in South Africa	733
Journal of the Western Province Agricultural Society	373
Rhodesia as a White Man's Country	731
Surveying for Settlers	470
Rhodesia Agricultural Union (Editorial)	255
„ as a Ranching Country (Editorial)	127
Rhodesian Leather (Editorial)	260
„ Maize Successes at Johannesburg (Editorial)	514
„ Milk Records 90, 224, 388, 471, 512, 618, 647,	739
„ Produce in Europe, by J. W. Downie	713
Rhodes Inyanga Estate, Cattle Returns, 1917-1921, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.	419
Rice, Swamp or Irrigated	709
Rinderpest	169
Rootworm of Maize	333
Rusape Show (Editorial)	266
„	449
St. O'Gorman Scientific Cattle Dip	79
Salisbury Experiment Station, 1920-21, 1921-22, Particulars of Experi- ments	45, 64
„ Show (Editorial)	8, 264, 507
Seasonal Forecasting, and Prospects for Rainfall Season 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.	648
Seed Maize (Editorial)	504
„ Supply in Rhodesia, by C. Mamwarung	548
Settlers' Guide (Editorial)	263
Shows, Bulawayo, Gwelo, Rusape, Umtali, Lomagundi	444
Show, Salisbury (Editorial)	8, 264, 507
„ Season (Editorial)	124
Some Common Diseases of Poultry, by A. Little	601, 702
Southern Rhodesia, Climatic Areas, by C. L. Robertson, B.Sc., A.M.I.C.E.	459
„ Egg Laying Test	93, 215, 218, 463, 727
„ Water Power Resources, by C. L. Robertson, B.Sc., A.M.I.C.E.	56

X.

	PAGE
Squeezer, Cattle	212
Statistics (Editorial)	383
„ Crop (Editorial)	4
„ of Crops, 1920-21, by H. C. K. Fynn	29
„ of Live Stock and Animal Produce for 1921, by H. C. K. Fynn	393
Stock Diseases in Southern Rhodesia (Editorial)	7
Summer Irrigation in Rhodesia, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.	683
Sunflower, by C. Mainwaring	295
„ Seed for Export	118
Sunn Hemp Seed from Rhodesia (Editorial)	390
Surveying for Settlers (Review)	470
Swamp or Irrigated Rice	709
Sweet Potato, by J. A. T. Walters, B.A.	411
Sword Bean	344
Three-Day Sickness	279
Tobacco, Common Mistakes in Growing and Handling Virginia, by H. W. Taylor, B.Agr.	37
„ First Rhodesian (Editorial)	644
„ Industry (Editorial)	389
„ Seed, Treatment against Wildfire and Angular Spot, by D. D. Brown	205
„ Slug (Editorial)	130
„ Yields (Editorial)	513
Toon Tree	458
Treatment of Tobacco Seed against Wildfire and Angular Spot, by D. D. Brown	205
Trees, Forest, Planting and Care of, by J. S. Henkel	687
Tree: The Toon	458
Trout in Rhodesia (Editorial)	389
Tsetse Fly, Eastern Border, by J. H. Chorley	680
Tuberculosis, Bovine	276
Ulcerous Lymphangitis	722
Umtali Show	450
Use of Pure Bred Sires for Dairy Herds, by T. Hamilton, M.A., N.D.A., N.D.D.	282
Vaccine, Contagious Abortion	470
„ Redwater and Gall-sickness	20
Velvet Bean, by J. A. T. Walters, B.A.	21
„ (Editorial)	385
„	341
Veterinary Bacteriologist's Report for 1921	605
„ Reports 96, 219, 345, 465, 619,	734
„ Treatment, an Indexed System (Review)	732
Visit to Gwebi Experiment Farm (Editorial)	256
„	461

	PAGE
Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.	56
Weather Bureau	105, 229, 353, 479, 752
White Poplar (Editorial)	265
White v. Yellow Maize	339
Wildfire and Angular Spot of Tobacco, by D. D. Brown	205
Winter Cereal Experiments, by D. E. McLoughlin	593
 Yeast, Lemon	 312
Yellow v. White Maize (Editorial)	505

AUTHORS.

	PAGE
Arnold, H. C.—	
Propagation of Kudzu Vine	435
Bevan, L. E. W., M.R.C.V.S.—	
The History, Control and Treatment of Infectious Abortion of Cattle in Southern Rhodesia	554
Blackshaw, G. N., O.B.E., B.Sc., F.I.C.—	
Limestones in Southern Rhodesia	73
Composition of Grasses	143
Brown, D. D.—	
Treatment of Tobacco Seed against Wildfire and Angular Spot in Southern Rhodesia	205
Cardwell, R. H.—	
Harvesting Operations at Gwebi Experiment Farm	718
Chorley, J. K.—	
Tsetse Fly, Eastern Border	680
Downie, J. W.—	
Rhodesian Produce in Europe	713
Fynn, H. C. K.—	
Statistics of Crops grown by Europeans in Southern Rhodesia for the Season 1920-21	29
The Baboon Trap	210
Statistics of Live Stock and Animal Products for the Year 1921	393
Gordon, G. H.—	
Chillies in Rhodesia	533
Hamilton, T., M.A., N.D.A., N.D.D.—	
Manufacture of Cheddar Cheese	177
The Use of Pure Bred Sires for Dairy Herds	282
Common Defects in Butter Making	402
Farm Cheese Making	675
Henkel, J. S.—	
Forestry in Southern Rhodesia. Planting and Care of Forest Trees	687
Jack, R. W., F.E.S.—	
Notes on the Maize Stalk Borer, or "Top Worm"	87
Notes from the Entomological Branch	333
Insect Pests of Fruits other than Citrus in Southern Rhodesia	569 and 664
Jennings, A. C., A.M.I.C.E., A.M.I.E.E.—	
Irrigation Canals	187
Summer Irrigation in Rhodesia	683
Little, A.—	
Poultry Husbandry: Mating for Improvement and Increased Egg Production	80
Housing and Feeding of Adult Birds	200
Some Common Diseases of Poultry	601 and 702

	PAGE
McLoughlin, D. E.—	
Winter Cereal Experiments, Season 1921	593
Mainwaring, C.—	
The Ground Nut, or Monkey Nut	150
The Common Sunflower	295
Seed Supply in Rhodesia	548
Maufe, H. B. —	
The Relative Areas of Geological Importance in Southern Rhodesia	280
Mundy, H. G., F.L.S.	
Annual Report of Experiments, 1920-21, Experiment Station, Salisbury	45
Arlington Sand Veld Experiment Station, 1st Report, 1921	68
Grasses of Agricultural Importance in Southern Rhodesia	134
Annual Report of Experiments, 1921-22, Experiment Station, Salisbury	536 and 694
Bulawayo Municipal Experiment Station, 1st Report	583
From Breeder to Butcher: Cattle Feeding Experiment No 10	588
Annual Report of Crop Experiments, Gwelo Experiment Farm, 1921-22	656
Nobbs, E. A., Ph.D., B.Sc., F.H.A.S. —	
The Cattle Industry	53, 453, 551, 711
From Breeder to Butcher: Cattle Feeding Experiment No 9	267
Rhodes Inyanga Estate Cattle Returns, 1917-1921	419
Needham, R. R.—	
The Flaying, Curing and Drying of Hides	342
Robertson, C. L., B.Sc., A.M.I.C.E.—	
Water Power Resources of Southern Rhodesia	56
Climatic Areas in Southern Rhodesia	459
The Possibility of Seasonal Forecasting, and Prospects for Rain-fall Season 1922-23	648
Smclair, J. M., M.R.C.V.S.—	
A Short History of the Infective Diseases amongst the Domestic Animals of Southern Rhodesia since the Occupation	10, 169, 276, 720
Steedman, Miss E. C.—	
A New Zealand Fruit Farm	85
Taylor, H. W., B.Agr.—	
Common Mistakes in Growing and Handling Virginia Tobacco	37
Turner, A. G.—	
Citrus Fruit Growing in Rhodesia	159 and 301
Walters, J. A. T., B.A.—	
The Velvet Bean	21
Malting Barley	83
The Sweet Potato	411

ILLUSTRATIONS.

	Facing Page
Poultry Pens, Rhodesia Egg Laying Test	1
Maize after Oat Stubble ploughed under	22
„ Velvet Bean Stubble ploughed under	22
A Pure Stand of Velvet Beans	24
Maize and Velvet Beans for Ensilage	24
Tobacco Plants at Great B Farm	40
„ topped at correct height	40
Burt Oats	46
Kherson Oats	46
Cape Early Rye	68
Rye at Arlington	68
<i>Paisé de Terre</i> House at Wensleydale Estate, Macheke	123
Rhodesia Tussock Grass	136
Buffalo Grass	136
Swamp Couch Grass	136
South African Star Grass	136
Fine Guinea Grass	138
Kikuyu Grass	138
Penhalonga Grass	138
Upright Paspalum	138
Native Paspalum	138
Golden Timothy, African Star Grass, Native Grass, Penhalonga Grass	142
Red Top Grass, Red Rhodes Grass, Buffel Grass, Buffalo Grass	142
Swamp Couch, Rhodes Grass, Perennial Canary Grass, False Paspalum	142
Ground Nuts	150
„ Virginia Bunch, Virginia Runner	154
„ Spanish Bunch	154
A Good Stand of Ground Nuts	154
Premier Estate, Umtali	166
Mazoe Citrus Estate	166
Cheddar Cheese Vat	177
Acidimeter	179
American Curd Knives	180
Curd Breaker	181
Cooler and Mill	182
Cheddar Hand or Power Mill	183
Telescopic Cheese Mould	184
Cheese Press	184
Gang Press	185
Irrigation Canals (Diagrams)	188 and 192
Cattle Squeezer	213
Delegates to Rhodesia Agricultural Congress, 1922	257
Gwebi Experiment Farm, Visit to	258
White Poplar, Forest Nursery, Salisbury	266
Cattle Feeding Experiment No. 9	270
Pure Bred Sires for Dairy Herds (Diagram)	284

	Facing Page
Volunteer Beggar Weed	290
Maize in Matabeleland	294
Sunflowers	298
Irrigation System for Citrus Trees	302
Orange Trees near Umtali	302
Pruning of Orange Trees	310
Furrow System for Citrus Groves	310
Maize Plant killed by Rootworm	334
Wild Rapoko Grass	334
Result of Rootworm Attack	336
Maize Rootworm, Pink Grub	336
Homestead on Mr. T. M. McMurray's Farm	383
„ Mr. V. M. Ewing's Ranch	383
Defective Packing of Butter	408
Streakiness in Butter	408
Sweet Potato Varieties	416
Cattle at Rhodes Inyanga Estate	424
“Blaaukrantz Molly II.”	444
“Avoca Avateer”	444
“Highfield Reminder II.”	448
“Black Band 2nd of Castlecrag”	448
“Molly's Buringa of Gloria”	448
Lalapansi Farmers' Exhibit, Gwelo Show	448
<i>Cedrela toona</i> Tree	458
Winning Pen, Light Breed Section, 2nd Egg Laying Test, Salisbury	464
Mr. T. Hepburn's Homestead	503
Mr. P. O. Brocklehurst's Homestead	503
General Smuts opening Salisbury Show	508
Salisbury Experiment Station, 1922	540
Sudan Grass	540
Maize after Niger Oil	540
„ Linseed	540
Fruit Piercing Moths: Plates I. and II.	572
„ Plates III., IV. and V.	576
„ Plate VI.	578
„ Plate VII.	665
„ Plate VIII.	669
„ Plate IX.	671
Black Persian Wheat at Ceres Farm, Shamva	594
Mrs. Boright's Homestead	641
Mr. V. Merandon's Homestead	641
Rainfall Forecasting, Charts	651, 653
Essentials for Farm Cheese Making	678
Milk in the Vat	678
The Curd	678
Woodforde Dolichos Bean	694
White Dolichos Bean	694
Cassava	694
Native Legumes for Green Manuring	698
Kudzu Vine	698

Indian Agricultural Research Institute (Pusa)
LIBRARY, NEW DELHI-110012

This book can be issued on or before.....

Return Date	Return Date